

20-1025 (Lead); 20-1138 (Consolidated)

**UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT**

ENVIRONMENTAL HEALTH TRUST; CONSUMERS FOR SAFE CELL
PHONES; ELIZABETH BARRIS; THEODORA SCARATO

CHILDREN'S HEALTH DEFENSE; MICHELE HERTZ; PETRA BROKKEN;
DR. DAVID O. CARPENTER; DR. PAUL DART; DR. TORIL H. JELTER; DR.
ANN LEE; VIRGINIA FARVER, JENNIFER BARAN; PAUL STANLEY, M.Ed.

Petitioners

v.

FEDERAL COMMUNICATIONS COMMISSION;
UNITED STATES OF AMERICA

Respondents

Petition for Review of Order Issued by the
Federal Communications Commission

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Addenda follows

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- FRAZER, J. W., pp. 15-32, "Empirical data on energy transfer models and application to primates"
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- BEISCHER, D. E., & RENO, V. R., pp. 80-96, "Naval Aerospace Medical Research Laboratory microwave facility"
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- FRAZER, J. W., pp. 115-132, "Use of temperature sensor implants and radiometric technique to monitor animal temperatures in RF fields"
- MITCHELL, J. C., pp. 133-138, "Modified exposure system for HF band RF radiation studies"
- GASS, A. E., JR., pp. 139-146, "Preliminary study of 26.6 MHz radiation on the growth rate of young mice"
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- MCLEES, B. D., & FINCH, E. D., pp. 165-174, "The effect of radio frequency irradiation on biologically important macromolecules"
- MCLEES, B. D., & FINCH, E. D., pp. 175-206, "The effects of radio frequency radiation on regenerating hepatic tissue"
- FINCH, E. D., pp. 207-235, "Experimental protocol for the irradiation of biological systems with radio frequency electromagnetic energy" and "An alternative to dielectric absorption: pulsed NMR determinations of the structure of 'bound' water and its interaction with radio frequency electromagnetic radiation"
- FINCH, E. D., HAMMON, J. F., & MULLER, B. H., pp. 236-242, "Self-diffusion of water in tissue"
- GLASER, Z. R., pp. 243-254, "Biological studies at microwave frequencies"
- SILVERMAN, C., pp. 255-267, "Followup study of radar workers"
- SCHWAN, H. P., & KRITIKOS, J. M., pp. 268-287, "Current microwave studies"
- STRAUB, K. R., pp. 288-300, "Preliminary results of non-ionizing radiation effects research"
- HUNT, E. L., & PHILLIPS, R. D., pp. 301-327, "Effects of microwave radiation on physiological behavioral factors and CNS excitability in laboratory animals"
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*Note: Items in this list have been alphabetized but the original numbering has been retained.

APPENDIX A

ACCESSION NUMBERS

<u>Prefix of Report Number</u>	<u>Agency Assigning Number</u>
AD-	Defense Documentation Center (DDC), formerly Armed Services Technical Information Agency (ASTIA)
JPRS-	Joint Publications Research Service
LC-ATD-	Library of Congress - Aerospace Technology Division
PB-	National Technical Information Service (NTIS), U. S. Dept. of Commerce
RADC-TR-	Rome Air Development Center, Griffiss Air Force Base, N. Y.
OTS-	Office of Technical Services, U. S. Dept. of Commerce
DA-	Department of the Army
SC-	Sandia Laboratory, Albuquerque, New Mexico
ACSI-	Assistant Chief of Staff for Intelligence (Army, Washington, D. C.)
CR-	National Aeronautics and Space Administration
N-	Scientific & Technical Aerospace Reports (STAR) of NASA
A-	International Aerospace Abstracts of Amer. Inst. of Aeronautics & Astronautics
X-	Classified NASA document (avail. from NASA Sci. & Tech. Info. Facility, P. O. Box 33, College Park, Md., 20740)
NLL-	National Lending Library for Science & Technology, Boston Spa, England

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US Agencies; US Department of Labor Comments, Jul. 12, 2015



Reply to the attention of:

JUL 1 2015

Received & Inspected

JUL 13 2015

FCC Mail Room

Mr. Julius Knapp
Chief
Office of Engineering and Technology
Federal Communications Commission
445 12th St SW
Washington, D.C. 20554

Dear Mr. Knapp:

Thank you for your recent letter requesting comments from the Occupational Safety and Health Administration (OSHA) on the FCC's *Notice of Inquiry*, dated March 29, 2013, regarding exposure limits and policies for radiofrequency (RF) emissions from FCC-regulated sources. We have reviewed the *Notice of Inquiry* and offer the following comments:

- RF emissions are not on OSHA's active regulatory agenda, so we have not conducted a comprehensive literature review or risk assessment on RF hazards. In light of the FCC's request for feedback on its *Notice of Inquiry*, however, we reviewed the FCC's existing RF occupational exposure limits and compared them to the recommended limits in relevant consensus standards. Our review indicated that the FCC's specific absorption rate (SAR) and maximum permissible exposure (MPE) limits for occupational exposures are fairly consistent with the current recommendations of the Institute of Electrical and Electronics Engineers (IEEE), the American Conference of Governmental Industrial Hygienists (ACGIH), and the International Commission on Non-Ionizing Radiation Protection (ICNIRP). We did identify some differences between the FCC's exposure limits and the limits in the consensus standards. For example:
 - The FCC's occupational localized spatial peak SAR of 8 W/kg (averaged over any 1 gram of tissue in the shape of a cube) for parts of the body other than extremities may be more protective, in some cases, than the IEEE's and ACGIH's corresponding SAR of 10 W/kg for frequencies between 100 kHz and 3 GHz (IEEE) or 100 MHz and 3 GHz (ACGIH) (averaged over any 10 g of tissue in the shape of a cube) and the ICNIRP's SAR of 10 W/kg for frequencies between 100 kHz and 10 GHz for the head and trunk (averaged over 10 g of contiguous tissue).
 - The FCC's occupational power density MPE limits are different than the recommended power density limits in the IEEE, ACGIH, and ICNIRP standards, as shown in the following table:

FCC			IEEE / ACGIH			ICNIRP		
Frequency (f, MHz)	Limit (mW/cm ²)	Averaging time (min)	Frequency (f, MHz)	Limit (mW/cm ²)	Averaging time (min)	Frequency (f, MHz)	Limit (mW/cm ²)	Averaging time (min)
30 – 300	1	6	100 – 300	1	6	10 - 400	1	6
300 – 1,500	f/300 (f is frequency in MHz)	6	300 – 3,000	f/300	6	400 – 2,000	f/400	6
1,500 – 100,000	5	6	3,000 – 30,000	10	$33,878.2/f^{1.079}$	2,000 – 10,000	5	6
			30,000 – 300,000	10	$67.62/f^{0.475}$	10,000 – 300,000	5	$68/f_G^{1.05}$ (f _G is frequency in GHz)

Despite these differences, we do not believe that there are any major deficiencies in the FCC's current occupational SAR and MPE limits. However, we encourage the FCC to contact the National Institute for Occupational Safety and Health (NIOSH) for additional input. With respect to non-thermal health effects, the FCC might also want to contact the National Toxicology Program (NTP) of the U.S. Department of Health and Human Services, which is currently conducting toxicology and carcinogenicity animal studies on RF emissions from mobile phones (NTP 2014).

- With respect to the issues raised regarding evaluation methods for determining compliance with SAR limits (*Notice of Inquiry*, paragraph 246), we believe that, given the current lack of standard computational procedures, it would be very useful for the FCC to develop a technical supplement to OET Bulletin 65 for fixed evaluation (including SAR). Such a supplement should provide guidance and examples for the common situation in which multiple fixed sources are collocated in the same area (e.g., a rooftop).
- Regarding contact burns (*Notice of Inquiry*, paragraphs 225-228), we encourage the FCC to promote awareness of the potential for burns to occur when construction activities result in a structure being placed in a radiation field emanating from AM broadcast antennas. We believe that it would be beneficial for the FCC to “provide publically available maps showing areas where electric fields exceed 10 V/m from AM broadcast stations” (*Notice of Inquiry*, paragraph 226).

In addition to the *Notice of Inquiry*, we reviewed the *Report and Order* and the *Further Notice of Proposed Rulemaking* that accompanied the *Notice of Inquiry*, and we offer the following comments on those materials:

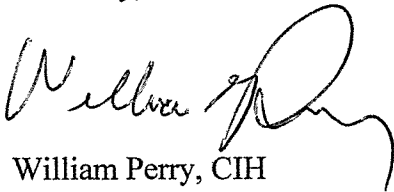
- We noticed that the FCC treats untrained occupational personnel as “transient” individuals in a controlled area (*Further Notice of Proposed Rulemaking*, paragraph 182), but does not include “third-party workers performing maintenance on the site for an extended period” in that same category (*Report and Order*, paragraph 76). We believe it would be helpful for the FCC to provide additional guidance on how to distinguish

between these two groups, as there appears to be considerable overlap. We are concerned about third-party workers (for example, employees of HVAC contractors) who have not received training in RF hazards and who may be unaware of RF exposures, particularly when they are working near RF sources on rooftops and building exteriors. We would like to open a dialog with the FCC on how to best ensure that third-party workers receive RF awareness training.

- Regarding signage, we strongly support the idea of a requirement for signs, maps, or diagrams to show where exposure limits are exceeded (*Further Notice of Proposed Rulemaking*, paragraph 182). However, we are concerned about the following language in proposed 47 CFR §1.1307(b)(2)(iii): “A label or small sign may be attached directly to the surface of an antenna within a controlled environment if it specifies a minimum approach distance where the occupational exposure limit is exceeded. If signs are not used at the occupational exposure limit boundary, controls or indicators (e.g., chains, railings, contrasting paint, diagrams, etc.) must designate the spatial regions where the occupational exposure limit is exceeded.” We do not believe that a small sign attached directly to the antenna would be sufficient to alert workers to the RF exposure hazard, as a worker could be exposed to RF hazards while approaching the RF source to read the sign. And we do not think the proposed language is clear in terms of where the required chains, railings, diagrams, or other indicators must be placed. We think the rule should more clearly state that a sign or other indicator must be posted at the occupational exposure limit boundary or at the access point to the antenna (ladder, roof access, chain, gate, etc). In addition, it is important for the FCC to require signage to be revised, as necessary, when additional RF sources are added to the site. For the case of multiple RF sources at a single site, we encourage the FCC to develop clear guidance on the appropriate procedures that should be used by licensees at that site to ensure compliance with FCC regulations.

We appreciate the opportunity to comment on these important issues that affect workers. If you have any further questions or concerns, please feel free to contact me directly at (202) 693-1950 or perry.bill@dol.gov.

Sincerely,



William Perry, CIH
Director
Directorate of Standards and Guidance

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NTP. National Toxicology Program. Cell Phone Radiofrequency Radiation Studies. Available online at http://www.niehs.nih.gov/health/assets/docs_a_e/cell_phone_radiofrequency_radiation_studies_508.pdf. November, 2014.

Radiation Sickness; Exemption for Firestations, California Assembly Bill No. 57
(2015), codified at Cal. Gov. Code 65964.1



AB-57 Telecommunications: wireless telecommunication facilities. (2015-2016)

Assembly Bill No. 57

CHAPTER 685

An act to add Section 65964.1 to the Government Code, relating to telecommunications.

[Approved by Governor October 09, 2015. Filed with Secretary of State
October 09, 2015.]

LEGISLATIVE COUNSEL'S DIGEST

AB 57, Quirk. Telecommunications: wireless telecommunication facilities.

Existing law requires a city, including a charter city, or county to administratively approve an application for a collocation facility on or immediately adjacent to a wireless telecommunications collocation facility, as defined, through the issuance of a building permit or a nondiscretionary permit, as specified. Existing law prohibits a city or county from taking certain actions as a condition of approval of an application for a permit for construction or reconstruction for a development project for a wireless telecommunications facility.

Under existing federal law, the Federal Communications Commission issued rulings establishing reasonable time periods within which a local government is required to act on a collocation or siting application for a wireless telecommunications facility.

This bill would provide that a collocation or siting application for a wireless telecommunications facility is deemed approved if the city or county fails to approve or disapprove the application within the reasonable time periods specified in applicable decisions of the Federal Communications Commission, all required public notices have been provided regarding the application, and the applicant has provided a notice to the city or county that the reasonable time period has lapsed.

Vote: majority Appropriation: no Fiscal Committee: no Local Program: no

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. Section 65964.1 is added to the Government Code, to read:

65964.1. (a) A collocation or siting application for a wireless telecommunications facility, as defined in Section 65850.6, shall be deemed approved if all of the following occur:

(1) The city or county fails to approve or disapprove the application within a reasonable period of time in accordance with the time periods and procedures established by applicable FCC decisions. The reasonable period of time may be tolled to accommodate timely requests for information required to complete the application or may be extended by mutual agreement between the applicant and the local government, consistent with applicable FCC decisions.

(2) The applicant has provided all public notices regarding the application that the applicant is required to

provide under applicable laws consistent with the public notice requirements for the application.

(3) (A) The applicant has provided notice to the city or county that the reasonable time period has lapsed and that the application is deemed approved pursuant to this section.

(B) Within 30 days of the notice provided pursuant to subparagraph (A), the city or county may seek judicial review of the operation of this section on the application.

(b) This section does not apply to eligible facilities requests.

(c) The Legislature finds and declares that a wireless telecommunications facility has a significant economic impact in California and is not a municipal affair as that term is used in Section 5 of Article XI of the California Constitution, but is a matter of statewide concern.

(d) As used in this section, the following terms have the following meanings:

(1) "Applicable FCC decisions" means In re Petition for Declaratory Ruling, 24 FCC Rcd. 13994 (2009) and In the Matter of Acceleration of Broadband Deployment by Improving Wireless Facilities Siting Policies, Report and Order, 29 FCC Rcd. 12865 (2014).

(2) "Eligible facilities request" has the same meaning as in Section 1455 of Title 47 of the United States Code.

(e) Except as provided in subdivision (a), nothing in this section limits or affects the authority of a city or county over decisions regarding the placement, construction, and modification of a wireless telecommunications facility.

(f) Due to the unique duties and infrastructure requirements for the swift and effective deployment of firefighters, this section does not apply to a collocation or siting application for a wireless telecommunications facility where the project is proposed for placement on fire department facilities.

Radiation Sickness - Firefighters; Susan Foster Comments, Sep. 2, 2013

FCC 13-39

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Reassessment of Federal Communications	)	ET Docket No. 13-84
Commission Radiofrequency Exposure Limits and)	
Policies)	
)	
Proposed Changes in the Commission's Rules	)	ET Docket No. 03-137
Regarding Human Exposure to Radiofrequency)	
Electromagnetic Fields)	
)	

To: Office of the Secretary
Federal Communications Commission
Washington, DC 20554

Comment Filed by: Susan D. Foster, MSW
15957 Avenida Calma
Rancho Santa Fe, CA 92091
susan.foster04@gmail.com
858 756-3532

September 2, 2013

AFFIDAVIT OF Susan D. Foster, MSW

State of California]

San Diego County]

I, Susan D. Foster, MSW, attest that my statements are true to the best of my knowledge.

Comment round for FCC ET Docket No. 13-84 and ET Docket No. 03-137

1. My name is Susan D. Foster, MSW. My address is 15957 Avenida Calma, Rancho Santa Fe, CA 92091.
2. I am a medical writer and the organizer of a brain study of California firefighters exposed to RF radiation from a cell tower adjacent to their fire station of over 5 years.
3. In 2004 I organized a pilot study of California firefighters who worked up to ninety (90) hours per week in fire stations with cell towers in close proximity to the two (2) stations where the firefighters work, eat, and sleep. The men were experiencing profound neurological symptoms following activation of the towers in 1999.
4. The symptoms experienced by the firefighters, all of whom had passed rigorous physical and cognitive exams prior to being hired by the fire department, included but were not limited to the following: headaches, extreme fatigue, sleep disruption, anesthesia-like sleep where the men woke up for 911 calls “as if they were drugged”, inability to sleep, depression, anxiety, unexplained anger, getting lost on 911 calls in the town they grew up in, a twenty (20) year medic forgetting basic CPR in the midst of resuscitating a coronary victim, immune-suppression manifest in frequent colds and flu-like symptoms.
5. The neurological testing and SPECT scans [single-photon emission computed tomography] of the brain were conducted by Gunnar Heuser, MD, PhD and J. Michael Uszler, MD. All six (6) firefighters were found to have brain abnormalities on SPECT scan. The doctors thought they would find areas of limited function in the brain based on the

symptomatology. Instead, they found a pervasive, hyper-excitability of the neurons which suggested the exposure to RF (microwave) radiation was causing the neurons to continually fire, without rest. RF radiation appeared to act as a constant stimulant even when the men were away from the station, and in repose. The SPECT scans were considered abnormal in all 6 firefighters.

6. Cognitive function, reaction time, and impulse control were measured objectively using T.O.V.A. testing [Test of Variables of Attention]. In all six (6) firefighters, impairment was found with cognitive function, reaction time and impulse control. Three (3) of the six (6) firefighters were captains. The captain on each shift is in charge of making life altering decisions for all firefighters and potential victims. They order firefighters into a burning building, and conversely, they order them out before a roof may collapse, for example. Impairment of all three critical functions could cost firefighters and the community they serve either life or limb.

7. The testing was conducted in 2004. The cell towers are in place at the two (2) fire stations where the test subjects work for the duration of a twenty-two (22) year lease. The men we tested have remained at the stations as this is the only work they know in the only community they have ever lived in. One (1) of the six (6) men tested did move to another department after his wife gave birth to an a boy who was diagnosed with Autism at age 2. This was the first live birth experienced by the “firefighter family” at this department since activation of the tower three (3) years earlier.

8. I have followed up with the firefighters who report continued symptoms as described in paragraph 4. Additionally, all firefighters report profound memory loss.

9. Two (2) of the firefighters, men we did not test in the pilot study but men who were exposed to RF radiation from the cell tower since their installation and activation in 1999, have gone out on psychiatric disability. This is almost unheard of among firefighters. The diagnosis was Post Traumatic Stress Disorder for one firefighter; he went out on an emergency run, and simply stopped talking after he returned to the station. The second

firefighter suffered an apparent break with reality. This occurred in the fire station when he returned following a short term disability for an unrelated injury. This break with reality was followed by an abrupt collapse and loss of consciousness. Because two (2) women have suffered strokes while in the fire station with the towers fully activated, Vascular Spasm Stroke (VSS) is suspected as a possible cause by Dr. Heuser and myself of having caused not only the strokes, but it is suspected in the potentially inaccurate diagnoses of the two (2) “psychiatric” cases among the firefighters. If not treated with rest and supplemental oxygen, it is possible for some VSS patients to have difficulty regaining speech and full cognitive abilities. This may be a case of misdiagnosis by the treating physicians who were unfamiliar with the potential of cell towers to create thermal effects well under the FCC limit of 1,000 $\mu\text{W}/\text{cm}^2$, thus heating blood in the brain and inducing VSS. Further study of these men is imperative.

10. What is particularly germane to the critical decisions the FCC is currently facing regarding RF safety guidelines is the fact the FCC currently allows 1,000 microwatts per centimeter squared ($\mu\text{W}/\text{cm}^2$) as an emission standard from cell towers. Yet all the symptoms attributed by the firefighters, as well as measurable brain and central nervous system abnormalities described above, occurred within close proximity to a cell tower measured at between 1 - 2 $\mu\text{W}/\text{cm}^2$ by Peter Sierck, BBEC, CEO of Environmental Testing & Technology in Encinitas, CA. Thus the emissions from towers were measured at approximately 1/1000th to 1/500th of the FCC’s allowable limit. “Hot spots” of reflected radiation were measured at 15 and 30 $\mu\text{W}/\text{cm}^2$, yet these “hot spots” were still a fraction of what the FCC allows. Therefore, **I strongly suggest the FCC is not basing its standards on biological effects by taking into consideration non-thermal effects, but rather physics with respect to the belief only thermal effects can be deleterious.** The FCC must recognize the principles of physics do not protect the brains and central nervous systems of the strongest among us, our firefighters.

11. The failure to protect our populations based on biological effects of exposure to RF (microwave) radiation at non-thermal levels is an inherent shortcoming of the current FCC policy with respect to cell tower emissions and cell phone absorption. The adverse biological

impact of these exposures are grossly underestimated. The FCC does not have independent science that can justify the massive exposure to RF radiation that currently exists from cell towers and cell phones. The story told by our small pilot study of firefighters in California should be a warning with respect to the current failure to recognize **harmful neurological impact of non-thermal levels of RF radiation**.

12. Based on the neurological abnormalities Dr. Heuser and I found in the firefighters, including hyper-excitability of the neurons which can result in cell death and consequent neuro-degenerative diseases such as Alzheimer's, Parkinson's Disease and ALS, I urge the FCC to reflect on the gravity of the decision facing you now, and I implore all Commissioners to reduce the allowable level of RF radiation immediately, and to not only recognize the adverse health effects from non-thermal levels of RF radiation, but to actively and aggressively protect and educate the general public through policy change and PSAs.

13. Finally, the FCC is not a health agency, yet it is entrusted with making decisions that impact the health of every American, including the unborn and those who cannot – through inability or lack of knowledge of the issues and dangers at hand – speak for themselves. Many consumers are encouraged through industry advertising to believe that their children will be disadvantaged if they do not have the latest wireless technology. Given the most recent culling of science in the BioInitiative Report 2012, this reckless promotion without any proof of safety puts them and their progeny at risk for neurological, immunological and reproductive harm. Furthermore, the “revolving door”-culture between the FCC and the telecommunications industry works against the best interest of consumers' health and safety. Both the FCC and the industry reach for a common refrain to hang on to their egregiously high regulatory limits which the FCC tries to pass off as “safety limits”, but clearly they are not. That refrain tells the public time and again that “there is a lack of scientific consensus about the adverse health effects” at exposure levels at or below the existing FCC limits. **No, there is not a true lack of consensus.** There is a flagrant disregard by the FCC for excellent, peer review science showing adverse health effects at less than 1% of what the FCC allows. Even if this were not the case, when have we determined everyone must be on the same side, the same page, before precautionary approaches are implemented? Did we

wait for this 100% accord on the science regarding DDT? No, if we had done that, Dow Chemical would never have agreed their product was dangerous and the world would be a less safe place than it is now. The same argument can be used for tobacco. It is past time for the FCC to lean toward the side of protecting human life rather than telecommunications industry profits. I contend a true Precautionary Approach would be both efficient and practical. It would protect human life, the quality of those lives, prevent disease, enhance the opportunity for human potential by not insidiously eroding our greatest natural resource – the human brain, and it would keep health care costs down. I implore the FCC to recognize that six (6) out of six (6) SPECT brain scans were abnormal for the firefighter subjects, and they are the strongest of the strong among us.

Respectfully submitted by

Susan D. Foster, MSW

15957 Avenida Calma

Rancho Santa Fe, CA 92091

September 2, 2013

Susan D. Foster, MSW

(electronically submitted)

Radiation Sickness; Electromagnetic Hypersensitivity,
Dr Erica Mallery-Blythe; 2014

Electromagnetic Hypersensitivity

A Summary by Dr Erica Mallery-Blythe

December 2014

WORKING DRAFT Version 1

For printing purposes:

The first 1-7 pages are body text, the rest are references. This document consists of 79 pages.

Author's note:

This summary is an expanded section of a larger document entitled "Electromagnetic Health for Children". The full document is designed in response to requests for information detailing current health concerns of electromagnetic fields (EMFs) with a focus on radiofrequency (RF) radiation. This is an expanded subsection covering EHS only.

Background:

We are currently witnessing the largest change to the Earth's electromagnetic environment that has ever taken place in human history. This change has taken place in the very short period of a handful of decades and continues to escalate at an exponential rate (Appendix 1). Given that household electricity, which was the first anthropogenic (man-made) electromagnetic field (EMF), only became prolific after the turn of the century, artificial EMF has barely seen one generation from cradle to grave. The use of higher frequency microwave devices such as mobile telephony, Wi-fi and smart meters, have suddenly become commonplace despite almost no safety testing and decades of evidence of potentially lethal effects. This has sparked a political and scientific debate that is gathering momentum on a daily basis, raising concern about the continued use of such devices. One may assume when witnessing the vast implementation of, for example Wi-fi in the home, school, workplace or public domain, that experts have provided sufficient evidence of safety to overwhelm scientific concern. This is not the case.

The World Health Organisation (WHO) / International Agency for Research on Cancer (IARC) Classified RF as a Group 2 B 'Possible Human Carcinogen' (2011). Despite this, there has been no attempt in the UK at disseminating this important information to the public. Conversely, it was not even mentioned in the AGNIR government commissioned report a year later in 2012. The only safety guidelines currently used in the UK are those constructed in 1998 regarding 'thermal (heating) effects' of non-ionising radiation. These are not protective of health given the vastly documented non-thermal effect taking place orders of magnitude below these levels. They are obsolete. Other countries have responded to this information and have safety limits more biologically sensible, thousands of times lower than here in the UK (see Appendix 2). Mechanistic data is available to explain these effects and every bodily system is affected (as one would expect from a radiation induced illness).

The very broad range of RF emitting devices on the market were never pre-market safety tested and many now contain fine print warnings from the manufacturers which warn that one must keep the devices a minimum distance from the body which in some cases is incompatible with use. The public are generally not aware of these warnings or the increased vulnerability of certain groups such as children, foetuses, elderly, pregnant women, infirm and those with EHS.

The full paper gives an overview of facts that should be considered during the policy change that is clearly necessary, and this subsection concerns Electromagnetic Hypersensitivity (EHS) only.

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Electromagnetic Hypersensitivity (EHS)**A Summary****1. Definition:**

Electromagnetic hypersensitivity is characterised by an awareness and/or adverse symptomatology in response to even extremely weak (orders of magnitude below current safety levels^{1,2}) electromagnetic fields of multiple types (in terms of frequency/intensity and waveforms). Relevant diagnostic coding that may be used by UK medical doctors include “idiopathic/environmental intolerance (IEI)”,^{3,4} code Z58.4 (Exposure to radiation) under the International Classification of Diseases (ICD-10),⁵ T66 (microwave syndrome)=“other unspecified effects of external causes: radiation sickness.”⁶

[Note: All life is electrosensitive to some degree and thresholds for conscious perception will vary depending on age, gender and individual physiology.^{7,8,9,10}]

2. Common symptoms include:

Headaches, dizziness, sleep disturbance, sensory up-regulation, palpitations, unusual pain in multiple sites, visual disturbance, auditory disturbance (esp tinnitus), membrane sensitivity, muscle twitching, dermatological complaints, hyperactivity /fatigue (depends on adrenal status/ state of EHS), restless leg syndrome, memory/concentration disturbance and anxiety^{11,12,13,14,15} (psychiatric symptoms such as anxiety and depression are likely to be secondary to the physiological effects rather than a primary cause¹⁶). Interestingly, with good avoidance, symptoms tend to disappear in the reverse order that they accumulated.

3. Characterised by multiple sensory up-regulation:

Up-regulation of all senses is commonly noted in persons with EHS, i.e. Photophobia and/or Scotopic sensitivity syndrome (visual sensitivity), Hyperacusis (hearing sensitivity), Hyperosmia (heightened sense of smell), Hypergeusia (heightened taste sensitivity), Hyperesthesia/Photosensitivity (heightened skin sensitivity) and Multiple Chemical Sensitivity (MCS) is associated.^{17,18,99,109}

4. Exposure induced:

EHS is a cumulative, exposure-triggered condition, and exposures are rising rapidly (see Appendix 1). Devices which emit RF and known to cause symptoms in those with EHS include: mobile phones, DECT cordless landlines, Wi-Fi/Bluetooth enabled laptop, desktop computers and laptops, Wi-Fi routers, Smart meters, fluorescent lighting, baby monitors, security systems, RFID systems and wireless gaming consoles. ELF (Extremely Low Frequency) fields (household electrical) will also cause symptoms in some individuals.

5. Characterised by increasing trigger susceptibility and irreversibility:

If EHS is unmanaged and there is general deterioration, there will be reaction to an increasingly broad range of frequencies at increasingly low intensities, i.e. the number of devices complained of triggering symptoms will increase and symptomatic distances will decrease.¹⁹ Tendency towards MCS will also increase and irreversibility will become more likely.²⁰

6. Highly prevalent:

Estimates for the number of people with EHS vary widely, but several countries report around 4-10%.^{21,22,23} **In the UK this corresponds to approximately 2.5 to 6.3 million²⁴** (which is more than the number of UK wheelchair users). This is likely to be a gross underestimation (see point 7 below) given that figures are based on the number of people who have made the connection between their symptoms and EMF exposure. The number of people who have mild EHS symptoms, but have not linked them yet to exposure would be far higher. Given the ubiquity of exposure now in all environments, it can be very difficult for people to notice the association.

7. Rapidly rising:

Extrapolated figures suggest that 50% of the population may be affected by 2017 (Appendix 3).

8. May affect everyone:

Interestingly, the signs and symptoms associated with RF exposures from e.g. mobile phone base stations,^{25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40} (also see Appendix 4) Wi-Fi,^{41,42} mobile phones,^{43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,140,143} radio/TV broadcasting transmitters,^{70,71,72,73,74} smart meters,⁷⁵ MRI scanners,^{76,77,78,79,80,81,82,83,84,85,86} and other RF sources^{87,88} **reveal that the general population (not known to be EHS) experience the same constellation of symptoms as are noted in EHS.** This is a dose-response relationship. Thus, it is possible that EHS could manifest in all members of the population with enough exposure. (Please note some of the above studies are demonstrating EHS symptoms in children.)

9. Proven physiological condition:

EHS has been demonstrated in a published, peer-reviewed, double blind research study,⁸⁹ as an **'environmentally inducible bona-fide neurological syndrome',⁹⁰** and other provocation tests corroborate this evidence.^{73,76,91,92,93,94,95,101} In addition, multiple papers have demonstrated physiological variations in those with EHS^{25,26,28,31,33,37,92,94,96,97,98,99,100,101,102,103,104,105,106,107,108,109,110,111,112,113} and genetic variations.⁹⁹ Furthermore, mechanisms are evolving that may explain the symptomatology of EHS.^{42,44,52,55,56,62,65,69,78,81,87,88,96,100,114,115,116,117,118,119,120,121,122,123,124,125,126} **Therefore, increasingly,** professional bodies are recognising this as a physiological condition.^{127,128,129,130,131,132,133,134,135}

10. Recognised by World Health Organisation (WHO):

The WHO states that **'symptoms are certainly real'** and **'in some cases can be disabling'**.¹³⁶ 'Some studies suggest that certain physiological responses of IEI individuals tend to be outside the normal range. In particular, the findings of hyper reactivity in the central nervous system and misbalance in the autonomic nervous system need to be followed up in clinical investigations and the results for the individuals taken as input for possible treatment.'¹¹³

11. Nocebo effect invalid:

Whilst the nocebo effect (physical symptoms induced by fear) has been suggested,¹³⁷ thorough investigation of individual histories renders this concept invalid in the majority of cases. Additionally, psychological therapies are much less effective at reducing symptoms than avoidance of electromagnetic fields¹³⁸ (see also point 14 below) and risk perception alone has not been felt adequate to explain the characteristics witnessed.¹⁷ Furthermore, evidence of EHS type symptomatology in studies involving small children, fetuses^{139,140,141,142,143} and

12. Recognised as a functional impairment:

- Under the disability act in Sweden,^{164,165} USA¹⁶⁶ and Canada.¹⁶⁷
- Legal cases are now being won for long term disability pensions/compensation (Australia,¹⁶⁸ France,¹⁶⁹ Spain,¹⁷⁰ UK¹⁷¹ and United States^{172,173}).
- Hospital facilities with low EMF have been constructed.¹⁷⁴
- Academic bodies urge immediate protection for those with EHS.^{175,176}
- The UN^{177,178} and the European Parliament¹⁷⁹ have made clear the requirement for equal opportunities for those with EHS.

13. Notable persons with EHS:

Well known, credible individuals such as Dr Gro Harlem Brundtland, Former Director-General of WHO and the first female Prime Minister of Norway¹⁸⁰ and Matti Niemelä, former Nokia Chief Technical Officer¹⁸¹ have been public regarding their Electromagnetic Hypersensitivity.

14. Medical guidelines for management exist:

Medical guidelines have been drawn up for doctors to diagnose^{95,182} and manage^{183,184,185} the condition physiologically with advice to urgently reduce exposure, and this advice is echoed by many other organizations.^{164,167,183,186,187,188,189,190,191,192,193,194} Additionally, research has shown avoidance can be the only reliable form of management to improve symptoms.^{138,195} Currently the most reliable way to diagnose EHS is via history, i.e. it is a clinical diagnosis,¹⁸² but there are other tests currently being used in the private sector and in the research forum believed by their users to be diagnostic or aid diagnosis.

15. Children have EHS:

Many children are currently affected, but undiagnosed. Children are likely to be more vulnerable to developing EHS since their exposure is higher (as explained above), and outcomes may be worse given their developing systems and greater time for latent effects. Children with EHS must be supported at school under the conditions stated in the 'Supporting pupils at school with medical conditions' Department for Education document (April 2014).¹⁹⁶

16. Vulnerable groups and white zones:

In addition to those with EHS and children, other vulnerable groups include the elderly, pregnant women, foetuses and those with co-morbidity (concurrent) illnesses. In order to protect vulnerable groups there has been increased call for designated, legally protected white zones (no or low EMF areas).^{197,198,199}

17. Socioeconomic impact of EHS and human rights:

It has been demonstrated that EHS is already affecting a very large number of people in the UK (see point 6) and given that a proportion of these people will be unable to work due to their condition, revenue is being lost.²⁰⁰ Additionally an extra burden is created on NHS resources due to inappropriate diagnosis and management of common symptoms, including in those who may be unaware they have EHS. In more severe cases, individuals are forced to live in extreme isolation, poverty and poor health. These individuals cannot access basic, life sustaining public amenities, such as grocery stores, petrol stations and health care facilities. There is therefore a clear breach of their human rights. We are aware

that some individuals are living in automobiles and tents which can also prove threatening to health and life, especially in extremes of temperature.

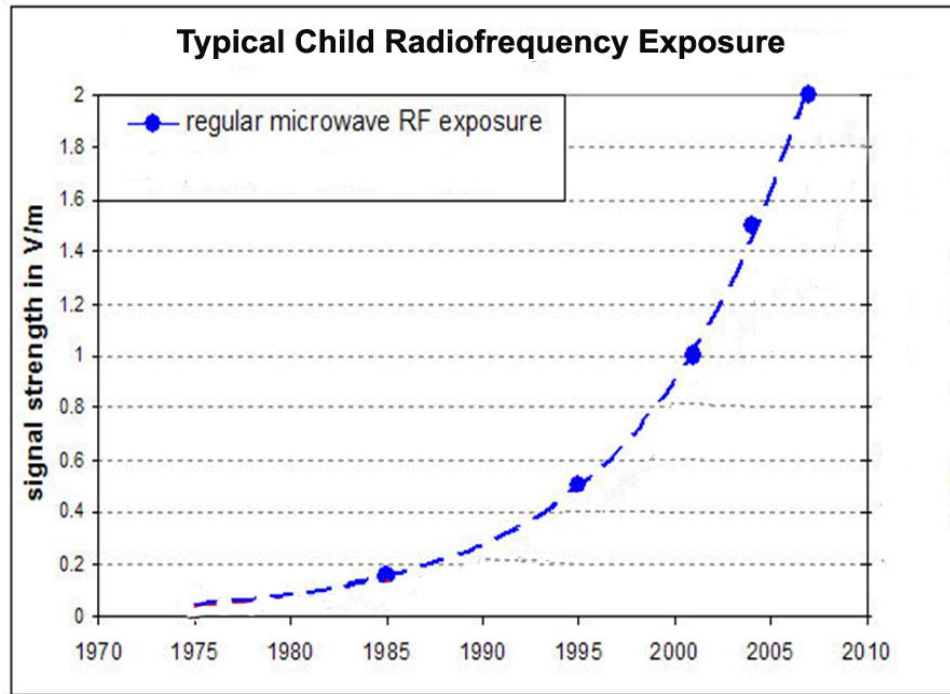
All EHS persons require 'comprehensive health evaluation':

"Because of the huge socioeconomic impact anticipated for EHS worldwide, the World Health Organization has devoted considerable attention to EHS, acknowledging this condition and recommending that people self-reporting sensitivities receive a comprehensive health evaluation".²⁰¹

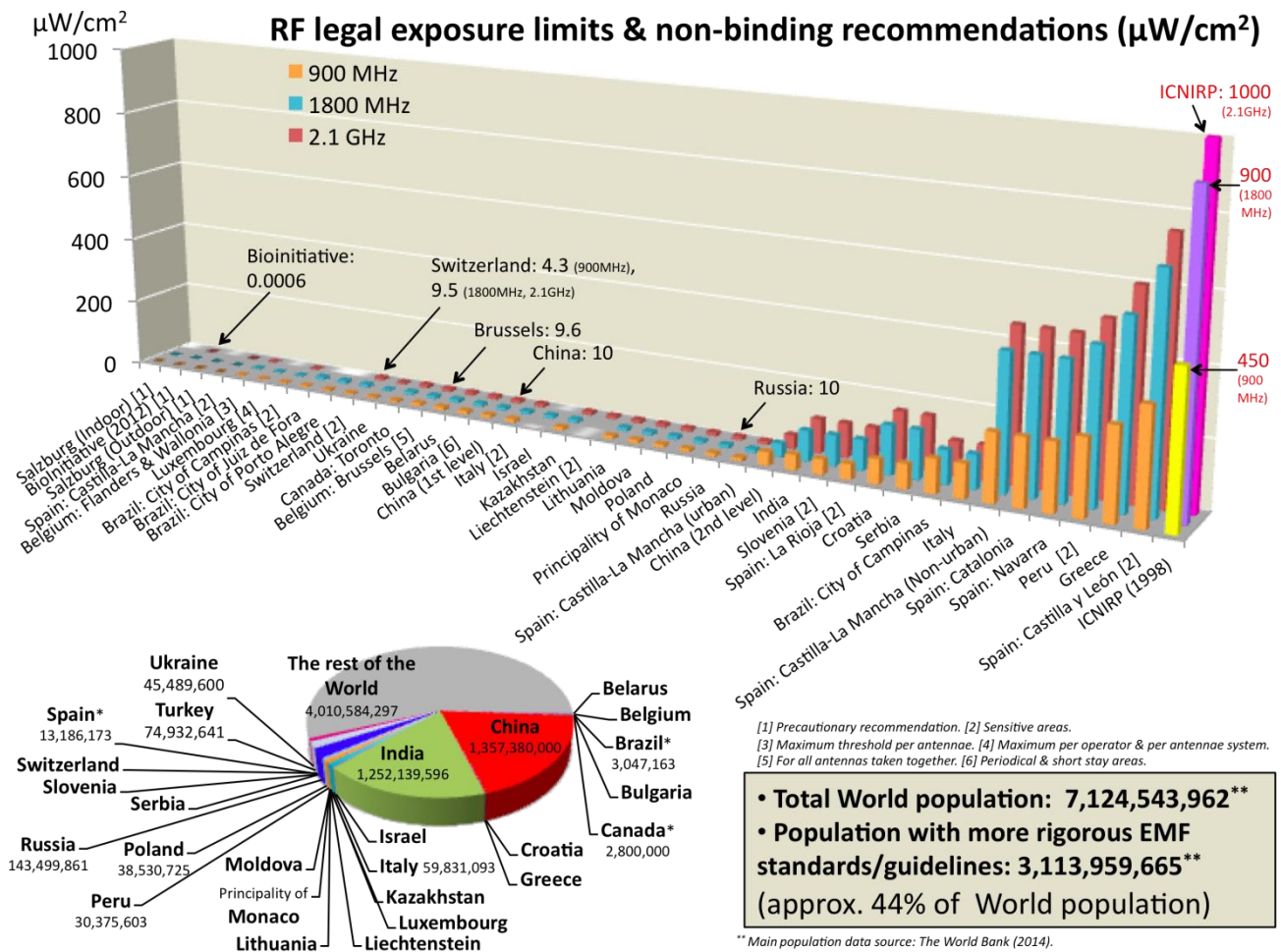
Author's notes:

I am contacted on a daily basis by a variety of different individuals including, persons with EHS, medical practitioners, school and parent groups, legal representatives, media and political bodies in the UK looking for medical advice on EHS or health effects of EMF in general. This is an increasingly demanding task and therefore I have founded a medical doctors organisation entitled PHIRE (Physicians' Health Initiative for Radiation and Environment) in order to increase the available support for those requesting it. **PHIRE aims to:**

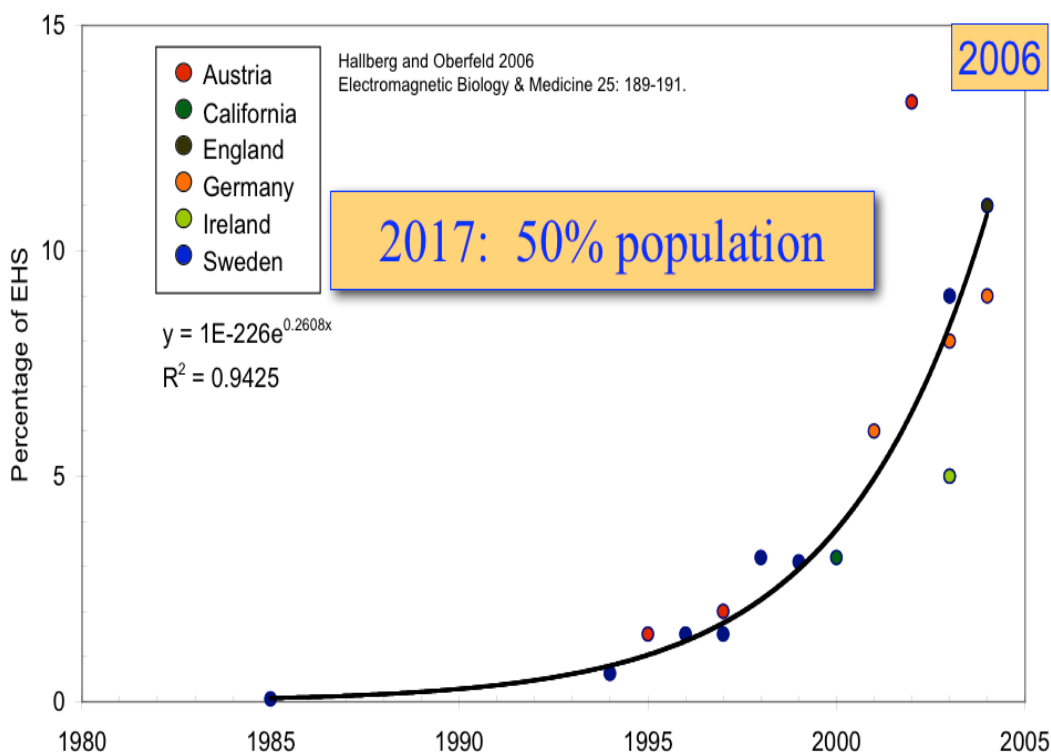
1. Create an academic programme for the education of medical practitioners to improve understanding of EMF related health effects.
2. Construct British medical guidelines for diagnosis and management of EHS.
3. Advise educational groups regarding protection of children from EMF exposure.
4. Increase awareness and support for adults and children with EHS and other vulnerable groups.
5. Expand current British research teams, and use global connections to maintain state-of-the-art education.
6. Open constructive dialogue with DOH (Department of Health)/PHE (Public Health England).
7. Advise on best practice public guidance.

APPENDIX 1

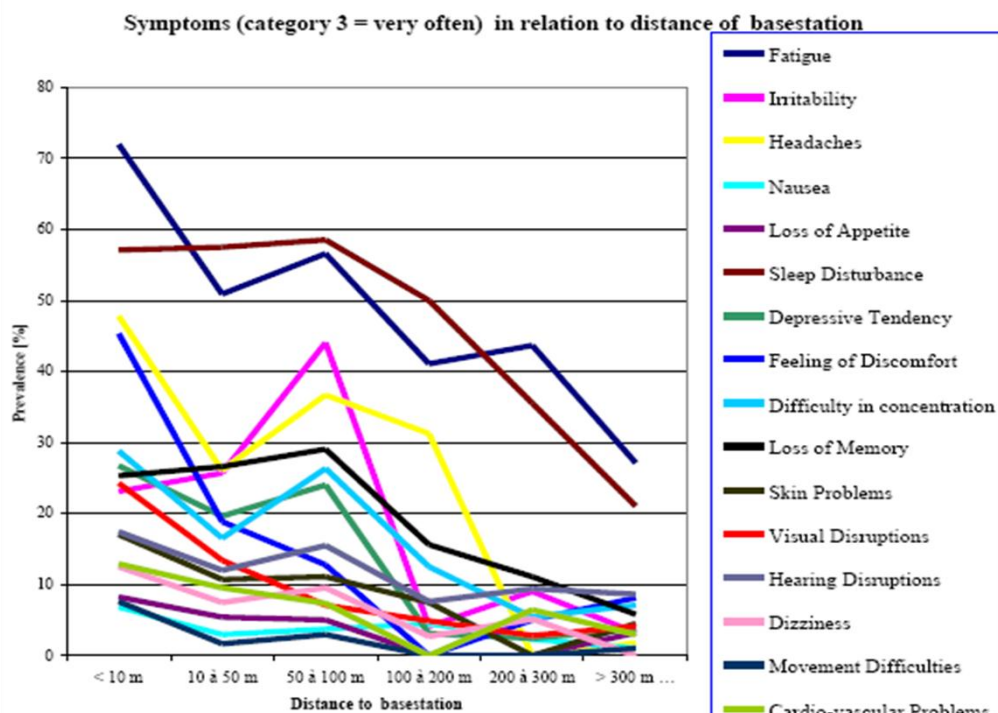
Alasdair Philips, Powerwatch <http://www.powerwatch.org.uk/>

APPENDIX 2

© Dr Isaac Jamieson 2014

APPENDIX 3**Estimated prevalence of EHS in various countries****APPENDIX 4****Santini et al 2002 - 2003**

- France
- 530 persons
- Selection by media announcement
- Exposure: participants' estimate of distance
- Outcome: list of 18 symptoms



DEFINITION:**1 Canadian Human Rights Commission, May 2007**

The Medical Perspective on Environmental Sensitivities

http://www.chrc-ccdp.gc.ca/sites/default/files/envsensitivity_en.pdf

B. Symptoms (p18)

A single, isolated low-level exposure (e.g. perfume on someone several seats away in the theatre or bus, that is not obviously harming the wearer) may cause significant symptoms such as headache, confusion, breathing difficulties or loss of balance in a person with environmental sensitivities. These symptoms may take minutes, hours or days to resolve. However, regular exposure to something to which one is sensitive may lead to habituation or “masking,” and chronic ill-health that may even be accepted as normal.

[Author’s note: the above paper refers to MCS but the phenomenon of a miniscule exposure causing potential catastrophic symptoms can also be seen in EHS. This amplification should not be surprising as it is also seen in anaphylaxis.]

2 Miller, 2001, Ann N Y Acad Sci. 2001 Mar;933:1-23.

The compelling anomaly of chemical intolerance.

<http://www.ncbi.nlm.nih.gov/pubmed/12000012>

[Author’s note: the above paper refers to MCS but the phenomenon of a miniscule exposure causing potential catastrophic symptoms can also be seen in EHS. This amplification should not be surprising as it is also seen in anaphylaxis.]

DEFINITION – DIAGNOSTIC CODING:**3 The Nordic Adaption of Classification of Occupationally Related Disorders (Diseases and Symptoms) to ICD-10**

Electrohypersensitivity (EHS) symptoms are classified as an **occupationally-related symptom-based diagnosis (code ICD-10) by the Nordic Council of Ministers since 2000.**

http://www.nordclass.se/icd10_e.htm

http://www.nordclass.se/ICD-10_Nordic%20Occupational_2000.pdf

R68.8 Other specified general symptoms and signs (page 33)

(suggested/recommended for multisymptomatic **“idiopathic/environmental intolerance” (IEI)**, including “multiple chemical sensitivity” (MCS); **“electromagnetic intolerance” (“el-allergy”)** etc. if the patient has not one major symptom which should preferably be coded)

‘Electromagnetic intolerance’ “EI-Allergy” (page 50)

Usually general symptoms (**tiredness, nausea, memory- and concentration difficulties etc. related to use of TV/PC/data-screens, electrical transformers or fluorescent lamps.** Symptoms disappear in “non-electrical environments”.

4 WHO Fact Sheet 296, December 2005

Electromagnetic fields and public health : Electromagnetic hypersensitivity

<http://www.who.int/peh-emf/publications/facts/fs296/en/>

A more general term for sensitivity to environmental factors is Idiopathic Environmental Intolerance (IEI).

5 Austria, 2012

Guideline of the Austrian Medical Association for diagnosis and treatment of EMF-related health problems and illnesses (EMF Syndrome)

<http://www.magdahavas.com/wordpress/wp-content/uploads/2012/06/Austrian-EMF-Guidelines-2012.pdf>

5. Diagnosis A diagnosis of EMF syndrome will largely be based on a comprehensive case history, focusing in particular on correlations between health problems and times and places of EMF exposure, as well as the progression of symptoms over time. In addition, measurements of EMF exposure and the results of additional diagnostic tests (laboratory tests, cardiovascular system) serve to support the diagnosis. Moreover, all other potential causes should be excluded as far as possible.

We recommend that the code Z58.4 (Exposure to radiation) under the International Classification of Diseases (ICD-10) be used for EMF syndrome for the time being.

6 WHO, International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10)-2015-WHO Version for ;2015

<http://apps.who.int/classifications/icd10/browse/2015/en#/T66>

Chapter XIX

Injury, poisoning and certain other consequences of external causes (S00-T98)

Other and unspecified effects of external causes (T66-T78)

T66 Unspecified effects of radiation

EMF PERCEPTION:

[Author's note: These studies involve ELF, however, RF perception can be reasonably assumed to follow similar patterns].

7 Blondin et al, 1996, Bioelectromagnetics. 1996;17(3):230-41.

Human perception of electric fields and ion currents associated with high-voltage DC transmission lines.

<http://www.ncbi.nlm.nih.gov/pubmed/8809363>

The objective of this study was to assess the ability of humans to detect the presence of DC electric field and ion currents. An exposure chamber simulating conditions present in the vicinity of high-voltage DC (HVDC) lines was designed and built for this purpose. In these experiments, the facility was used to expose observers to DC electric fields up to 50 kV/m and ion current densities up to 120 nA/m². Forty-eight volunteers (25 women and 23 men) between the ages of 18 and 57 years served as observers. Perception of DC fields was examined by using two psychophysical methods: an adaptive staircase procedure and a rating method derived from signal-detection theory. Subjects completed three different series of observations by using each of these methods; one was conducted without ion currents, and the other two involved various combinations of electric fields and ion currents. Overall, subjects were significantly more likely to detect DC fields as the intensity increased. Observers were able to detect the presence of DC fields alone, but only at high intensities; the average threshold was 45 kV/m. Except in the most sensitive individuals, ion current densities up to 60 nA/m² did not significantly facilitate the detection of DC fields. However, higher ion current densities were associated with a substantial lowering of sensory thresholds in a large majority of observers.

Data analysis also revealed large variations in perceptual thresholds among observers. Normative data indicating DC field and ion current intensities that can be detected by 50% of all observers are provided. **In addition, for the most sensitive observers, several other detection proportions were derived from the distribution of individual detection capabilities.** These data can form the basis for environmental guidelines relating to the design of HVDC lines.

8 Leitgeb et al, 2006, J Med Eng Technol. 2006 Sep-Oct;30(5):306-9.

Electric current perception of children: the role of age and gender.

<http://www.ncbi.nlm.nih.gov/pubmed/16980285>

Although it is widely accepted that children merit increased protection, little is known about the quantitative consequences of electric currents when setting safety limits. Measurements were performed on 240 children (117 girls and 123 boys) older than 9 years. **It was found that the electrosensitivity of children was higher than that of adults,** but did not exceed the overall span of adult electrosensitivity. Girls' results depend only weakly on age. Therefore, no major change should be expected below the age of 9. **The electrosensitivity of boys increases with decreasing age;** however, it finally approaches and merges with that of girls. The results imply that the factor by which the allowed touch current should be reduced for children depends on the perception probability level considered. The reduction factor of 2, as chosen in the past, would need revision either in regard to its value or to the related perception probability level. If related to the still existing rationale for safety limits the factor would need to be far higher.

9 Leitgeb & Schroettner, 2002, J Med Eng Technol. 2002 Jul-Aug;26(4):168-72.

Electric current perception study challenges electric safety limits.

<http://www.ncbi.nlm.nih.gov/pubmed/12396332>

Although a key parameter for safety regulations, the electric current perception threshold is not sufficiently established yet. Present knowledge suffers from a lack of women's data, small numbers of data on investigation of men and investigated samples non-representative for the general population. With measurement at 708 adults aged between 16 and 60 years (349 men and 359 women) these deficiencies could be overcome. The results are important. They show that the **perception variability among the general population is 100-fold higher than estimated so far and that the currently used estimate of the threshold is more than 10-fold too high.** Besides this, it could be shown that there are an over-proportion of more sensitive women compared with men indicating the need for revision of the present

assumptions on gender-specific differences in electrosensitivity. The results show that the existing assumptions on safety limits and remaining safety factors need serious review. In any case, relaxation of safety requirements is not justified.

10 McCarty et al, Int J Neurosci. 2011 Dec;121(12):670-6.

Electromagnetic hypersensitivity: evidence for a novel neurological syndrome.

<http://www.ncbi.nlm.nih.gov/pubmed/21793784>

<http://andrewamarino.com/PDFs/171-IntJNeurosci2011.pdf> (full paper)

... A possible nonpsychological basis for EMF hypersensitivity was provided by the discovery of the ability of human beings to detect weak EMFs, as evidenced by the occurrence of field-onset and field-offset brain potentials (Carrubba, Frilot, Chesson, & Marino, 2007), and the induction of steady-state changes in brain electrical activity that persisted during the presence of the field (Marino, Carrubba, Frilot, Chesson, & Gonzalez-Toledo, 2010)....

COMMON SYMPTOMS:

11 **American Academy of Environmental Medicine (AAEM), 2012**

Electromagnetic and Radiofrequency Fields Effect on Human Health (Dec 2012)

http://aaemonline.org/emf_rf_position.html

Other neurological and cognitive disorders such as headaches, dizziness, tremors, decreased memory and attention, autonomic nervous system dysfunction, decreased reaction times, sleep disturbances and visual disruption have been reported to be statistically significant in multiple epidemiological studies with RF exposure occurring non-locally.

12 **Austrian Medical Association, 2012**

Guideline of the Austrian Medical Association for diagnosis and treatment of EMF-related health problems and illnesses (EMF Syndrome)

<http://www.magdahavas.com/wordpress/wp-content/uploads/2012/06/Austrian-EMF-Guidelines-2012.pdf>

Background (page 3)

Among others, the following symptoms were reported as occurring frequently: sleep problems (58%), headaches (41%), nervousness (19%), fatigue (18%) and difficulty concentrating (16%). The respondents listed mobile phone base stations (74%), cell phones (36%), cordless phones (29%) and high-voltage lines (27%) as causes. Two thirds of respondents had taken measures to reduce their symptoms, the most frequent measure being to avoid exposure.

1. History of health problems and EMF exposure (page 6)

Most EMF-related symptoms fall within the scope of so-called stress-related health problems, e.g. sleep problems, fatigue, exhaustion, lack of energy, restlessness, heart palpitations, blood pressure problems, muscle and joint pain, headaches, depression, difficulty concentrating, forgetfulness, anxiety, urinary urgency, anomia, dizziness, tinnitus and sensations of pressure in the head and the ears.

13 Genuis and Lipp , 2012, Sci Total Environ. 2012 Jan 1;414:103-12.

Electromagnetic hypersensitivity: fact or fiction?

<http://www.ncbi.nlm.nih.gov/pubmed/22153604>

Table 1 (page 105)

Common reported signs and symptoms associated with electromagnetic hypersensitivity (EHS).

Some common signs and symptoms of electromagnetic hypersensitivity (Havas, 2006; Johansson, 2006) Headache, Thought processing difficulties, Memory impairment, Heart palpitations, Sleep disorder, General malaise, Blurred vision, Weakness, Dizziness, Chest discomfort, Muscle pain, Tinnitus, Fatigue, Nausea, Night sweats, Restless legs, Paresthesias.

14 Hagström et al, 2013, Pathophysiology. 2013 Apr;20(2):117-22.

Electromagnetic hypersensitive Finns: Symptoms, perceived sources and treatments, a questionnaire study.

<http://www.ncbi.nlm.nih.gov/pubmed/23557856>

The aim was to analyze the subjective experiences of Finns who describe themselves as suffering from electromagnetic hypersensitivity (EHS), their symptoms, self-perceived sources of the health complaints and the effectiveness of medical and complementary alternative therapies. A total of 395 questionnaires were mailed to self-diagnosed EHS persons. Of the participants 345 belonged to a Finnish self-help group and 50 came from outside of the group. The return rate of the study was 52.1% (206) and 80.9% of the respondents were women. Before the onset of EHS the most common health complaints were different types of allergies (35.1%, 68). **During the acute phase of EHS the most**

common symptoms were nervous system related: "stress" (60.3%, 117), "sleeping disorders" (59.3%, 115) and "fatigue" (57.2%, 111). The sources that were most often reported to have triggered EHS were: "personal computers" (50.8%, 94) and "mobile phones" (47.0%, 87). The same devices were also claimed to cause the most symptoms during the acute phase. After the acute phase of EHS had passed, the respondents still claimed to react to these same digital and wireless devices while their reactions to basic electrical appliances were reduced.

15 Kato & Johansson, 2012, Pathophysiology. 2012 Apr;19(2):95-100.

Reported functional impairments of electrohypersensitive Japanese: A questionnaire survey.

<http://www.ncbi.nlm.nih.gov/pubmed/22458999>

An increasing number of people worldwide complain that they have become electromagnetic hypersensitive (EHS). We conducted a questionnaire survey of EHS persons in Japan. The aim was to identify electromagnetic fields (EMF) and plausible EMF sources that caused their symptoms. Postal questionnaires were distributed via a self-help group, and 75 participants (95% women) responded. Reported major complaints were "fatigue/tiredness" (85%), "headache", "concentration, memory, and thinking" difficulty (81%, respectively). Seventy-two per cent used some form of complementary/alternative therapy. The most plausible trigger of EHS onset was a mobile phone base station or personal handy-phone system (37%). Sixty-five percent experienced health problems to be due to the radiation from other passengers' mobile phones in trains or buses, and 12% reported that they could not use public transportation at all. Fifty-three percent had a job before the onset, but most had lost their work and/or experienced a decrease in income. Moreover, 85.3% had to take measures to protect themselves from EMF, such as moving to low EMF areas, or buying low EMF electric appliances. EHS persons were suffering not only from their symptoms, but also from economical and social problems.

16 Canadian Human Rights Commission, May 2007

The Medical Perspective on Environmental Sensitivities

http://www.chrc-ccdp.gc.ca/sites/default/files/envsensitivity_en.pdf

Physical or psychological origins (page 22)

Recent research with better defined patient populations concluded that **psychiatric symptoms are more likely to stem from, rather than to cause, symptoms of environmental sensitivities**. Development of sensitivities usually pre-dates symptoms of depression and anxiety in people with sensitivities, with 1.4% of patients identifying problems before the onset of sensitivities and 38% reporting the development of depression, anxiety and other symptoms after sensitivities became apparent.

Table 7: Environmental sensitivity symptoms/reactions (page 19)

Body system	Symptoms
Nervous system	Heightened sense of smell Difficulty concentrating Difficulty remembering Apparent variability in mental processes Feeling dull or groggy Feeling "spacey" Headaches Restlessness, hyperactivity, agitation, insomnia Depression Lack of coordination or balance Anxiety Seizures Tinnitus
Upper respiratory system	Stuffy nose, itchy nose (the "allergic salute") Blocked ears Sinus stuffiness, pain, infections
Lower respiratory system	Cough Wheezing, shortness of breath, heavy chest Asthma Frequent bronchitis or pneumonia

Eyes	Red, watery eyes Dark circles under eyes Pain in eyes Blurred, disturbed vision
Gastrointestinal system	Heartburn Nausea Bloating Constipation Diarrhea Abdominal pain
Endocrine system	Fatigue, lethargy Blood sugar fluctuations
Musculoskeletal system	Joint and muscle pain in the extremities and/or back Muscle twitching or spasms Muscle weakness
Cardiovascular system	Rapid or irregular heartbeat Cold extremities High or low blood pressure
Skin (dermatological system)	Flushing (whole body, or isolated, such as ears, nose or cheeks) Hives Eczema Other rashes Itching
Genitourinary system	Frequency and urgency to urinate Painful bladder spasms

Summary (page 20)

Environmental sensitivities may affect every system in the body, so multiple symptoms are possible, with variation among individuals.

CHARACTERISED BY MULTIPLE SENSORY UP-REGULATION:

See also: De Luca 2014⁹⁹, Nordin 2014¹⁰⁹.

17 Levallois et al, 2002, Environ Health Perspect. 2002 Aug;110 Suppl 4:619-23.

Study of self-reported hypersensitivity to electromagnetic fields in California.

<http://www.ncbi.nlm.nih.gov/pubmed/12194896>

Cases of alleged hypersensitivity to electromagnetic fields (EMFs) have been reported for more than 20 years, and some authors have suggested some connection with the "multiple chemical sensitivity" illness. We report the results of a telephone survey among a sample of 2,072 Californians. Being "allergic or very sensitive" to being near electrical devices was reported by 68 subjects, resulting in an adjusted prevalence of 3.2% (95% confidence interval = 2.8, 3.7).

Twenty-seven subjects (1.3%) reported sensitivity to electrical devices but no sensitivity to chemicals. Characteristics of the people reporting hypersensitivity to EMFs were generally different from those of people reporting being allergic to everyday chemicals. Alleging environmental illness or multiple chemical sensitivity diagnosed by a doctor was the strongest predictor of reporting being hypersensitive to EMFs in this population. Other predictive factors apart from self-reporting chemical sensitivity were race/ethnicity other than White, Black, or Hispanic; having low income; and being unable to work. The perception of risk of exposure to EMFs through the use of hair dryers (vs. exposure to power and distribution lines) was the factor the most associated with self-reporting about hypersensitivity to EMFs. **However, risk perception was not sufficient to explain the characteristics of people reporting this disorder.**

18 WHO Fact Sheet 296, December 2005

Electromagnetic fields and public health : Electromagnetic hypersensitivity

<http://www.who.int/peh-emf/publications/facts/fs296/en/>

EHS resembles multiple chemical sensitivities (MCS), another disorder associated with low-level environmental exposures to chemicals.

CHARACTERISED BY INCREASING TRIGGER SUSCEPTIBILITY AND IRREVERSIBILITY:**19 Canadian Human Rights Commission, May 2007**

The Medical Perspective on Environmental Sensitivities

http://www.chrc-ccdp.gc.ca/sites/default/files/envsensivity_en.pdf

B Prevalence (page 5)

However, recent studies have revealed genetic links to sensitivities, and biochemical differences between people with sensitivities and “control” populations. Clinical experience shows that increasing chemical exposures are associated with increasing symptoms and reports of **sensitivity spreading to more incitants**.

[Author’s note: this observation in MCS is also noted in EHS, i.e. increasing EMF exposures are associated with increasing symptoms and reports of sensitivity spreading to more EMF incitants.]

A Agents initiating the condition of environmental sensitivities and triggering

Reactions (page 16)

Once people are initially sensitized to low levels of environmental factors, they may experience reactions triggered by a broader range of exposures if the condition is not recognized and addressed. In this two-stage process, environmental sensitivities may develop gradually with chronic exposure to relatively low levels of chemicals as seen in “sick buildings,” or suddenly after a major exposure to an environmental disaster or a chemical spill.

20 Canadian Human Rights Commission, May 2007

The Medical Perspective on Environmental Sensitivities

http://www.chrc-ccdp.gc.ca/sites/default/files/envsensivity_en.pdf

Summary (page 26)

The balance of scientific evidence and experience indicates that environmental sensitivities generally arise from physiological causes, although there are many neurological and psychological consequences.

HIGHLY PREVALENT:**21 Schröttner and Leitgeb, 2008, BMC Public Health. 2008 Sep 12;8:310.**

Sensitivity to electricity--temporal changes in Austria.

<http://www.ncbi.nlm.nih.gov/pubmed/18789137>

"This study showed an actual EHS prevalence of **3.5%** compared with 2% estimated in 1994".

22 Schreier, Huss and Rösli, 2006, Sozial- und Präventivmedizin, July 2006, Volume 51, Issue 4, pp 202-209

The prevalence of symptoms attributed to electromagnetic field exposure: a cross-sectional representative survey in Switzerland

<http://www.ncbi.nlm.nih.gov/pubmed/17193782>

"We found a prevalence of 5% (95% CI 4–6%) for electromagnetic hypersensitivity (EHS) in our study sample. The most common health complaints among EHS individuals were sleep disorders (43%) and headaches (34%), which were mostly attributed to power lines and mobile phone handsets."

23 O. Johansson, Pathophysiology 16 (2009) 157–177

Disturbance of the immune system by electromagnetic fields—A potentially underlying cause for cellular damage and tissue repair reduction which could lead to disease and impairment

[http://www.pathophysiologyjournal.com/article/S0928-4680\(09\)00035-2/fulltext](http://www.pathophysiologyjournal.com/article/S0928-4680(09)00035-2/fulltext)

The functional impairment electrohypersensitivity is reported by individuals in the United States, Sweden, Switzerland, Germany, Belgium, Italy, The Netherlands, Norway, Denmark and many other countries of the world. Estimates range from 3% to perhaps 10% of populations, and appear to be a growing condition of ill-health leading to lost work and productivity.

24 UK 2011 Population Census

http://en.wikipedia.org/wiki/Demography_of_the_United_Kingdom

The estimated population of the United Kingdom in the 2011 census was 63.182 million.

EHS GENERAL POPULATION SIGNS & SYMPTOMS - MAY AFFECT EVERYONE**EHS GENERAL POPULATION SIGNS & SYMPTOMS – BASE STATIONS:**

25 Abdel-Rassoul et al, 2007, Neurotoxicology. 2007 Mar;28(2):434-40.

Neurobehavioral effects among inhabitants around mobile phone base stations.

<http://www.ncbi.nlm.nih.gov/pubmed/16962663>

Results: The prevalence of neuropsychiatric complaints **as headache (23.5%), memory changes (28.2%), dizziness (18.8%), tremors (9.4%), depressive symptoms (21.7%), and sleep disturbance (23.5%)** were significantly higher among exposed inhabitants than controls: (10%), (5%), (5%), (0%), (8.8%) and (10%), respectively ($P < 0.05$). The NBTB indicated that the exposed inhabitants exhibited a significantly lower performance than controls in one of the tests of attention and short-term auditory memory [Paced Auditory Serial Addition Test (PASAT)]. Also, the inhabitants opposite the station exhibited a lower performance in the problem solving test (block design) than those under the station. All inhabitants exhibited a better performance in the two tests of visuomotor speed (Digit symbol and Trailmaking B) and one test of attention (Trailmaking A) than controls. The last available measures of RFR emitted from the first mobile phone base station antennas in Menoufiya governorate were less than the allowable standard level.

Conclusions: Inhabitants living nearby mobile phone base stations are at risk for developing neuropsychiatric problems and some changes in the performance of neurobehavioral functions either by facilitation or inhibition. So, revision of standard guidelines for public exposure to RER from mobile phone base station antennas and using of NBTB for regular assessment and early detection of biological effects among inhabitants around the stations are recommended.

26 Augner et al, 2010, Biomed Environ Sci. 2010 Jun;23(3):199-207.

<http://www.ncbi.nlm.nih.gov/pubmed/20708499?dopt=Abstract>

Effects of exposure to GSM mobile phone base station signals on salivary cortisol, alpha-amylase, and immunoglobulin A.

OBJECTIVE:

The present study aimed to test whether exposure to radiofrequency electromagnetic fields (RF-EMF) emitted by mobile phone base stations may have effects on salivary alpha-amylase, immunoglobulin A (IgA), and cortisol levels.

METHODS:

Fifty seven participants were randomly allocated to one of three different experimental scenarios (22 participants to scenario 1, 26 to scenario 2, and 9 to scenario 3). Each participant went through five 50-minute exposure sessions. The main RF-EMF source was a GSM-900-MHz antenna located at the outer wall of the building. In scenarios 1 and 2, the first, third, and fifth sessions were "low" (median power flux density 5.2 microW/m²) exposure. The second session was "high" (2126.8 microW/m²), and the fourth session was "medium" (153.6 microW/m²) in scenario 1, and vice versa in scenario 2. Scenario 3 had four "low" exposure conditions, followed by a "high" exposure condition. Biomedical parameters were collected by saliva samples three times a session. Exposure levels were created by shielding curtains.

RESULTS:

In scenario 3 from session 4 to session 5 (from "low" to "high" exposure), an increase of cortisol was detected, while in scenarios 1 and 2, a higher concentration of alpha-amylase related to the baseline was identified as compared to that in scenario 3. IgA concentration was not significantly related to the exposure.

CONCLUSIONS:

RF-EMF in considerably lower field densities than ICNIRP-guidelines may influence certain psychobiological stress markers.

[Exposure: 900 MHz; 5 x 50 mins; power flux density 5.2, 153.6 and 2126.8 µW/m², SAR unspecified]

27 Bortkiewicz et al, 2004, Med Pr. 2004;55(4):345-51.

Subjective symptoms reported by people living in the vicinity of cellular phone base stations: review.

<http://www.ncbi.nlm.nih.gov/pubmed/15620045> (article in Polish).

A questionnaire was used as a study tool. The results of the questionnaire survey reveal that people living in the vicinity of base stations report various complaints **mostly of the circulatory system, but also of sleep disturbances, irritability, depression, blurred vision, concentration difficulties, nausea, lack of appetite, headache and vertigo**. The performed studies showed the relationship between the incidence of individual symptoms, the level of exposure, and the distance between a residential area and a base station. **This association was observed in both groups of persons, those who linked their complaints with the presence of the base station and those who did not notice such a relation.**

28 Buchner and Eger, 2011, Umwelt - Medizin - Gesellschaft 2011; 24 (1): 44 - 57

Modification of clinically important neurotransmitters under the influence of modulated high-frequency fields - A long-term study under true-to-life conditions

http://www.umg-verlag.de/umwelt-medizin-gesellschaft/111_be_z.pdf

This long-term study over one and a half years shows a significant activation of the 60 participants' adrenergic systems after the installation of a regional mobile telephone transmitting station in the village of Rimbach (Bavaria). The values of the stress hormones adrenaline and noradrenaline grow significantly during the first six months after starting the GSM transmitter; the values of the precursor substance dopamine decreases substantially after the beginning of the radiation (Wilcoxon test, $p < 0,0002$). **The initial condition is not restored even after one and a half years.** Due to the not regulable chronic difficulties of the stress balance, **the phenylethylamine (PEA) values drop until the end of the research period (Wilcoxon test, $p < 0,0001$).** **The effects show a dose effect relation and are situated far under the valid limits for technical high-frequency stress. Chronic dysregulations of the catecholamine system have a substantial health relevance and cause health damages in the long run.**

29 Eger, H. & Jahn, M., 2010, Umwelt - Medizin - Gesellschaft 2010; 23 (2): 130 – 139

Specific symptoms and radiation from mobile basis stations in Selbitz, Bavaria, Germany: evidence for a dose-effect relationship.

<http://www.emf-portal.de/viewer.php?l=e&aid=18762> (original article in German)

<http://ebookbrowse.net/eger-jahn-selbitz-study-2010-english-pdf-d404387440> (full article in English)

In January 2009 the administration of the Bavarian Municipality of Selbitz gathered relevant data from 251 residents as part of a health survey. Subsequently, the data were assessed based on the exposure levels of cell phone radiation. In a next step, the exposure levels based on residential location and available RF measurements of local cell phone radiation levels were used to classify participants into exposure groups. The mean radiation exposure level of the highest exposure group in Selbitz (1.2V/m) was substantially higher than that of the study population in the QUEBEC study of the German Mobile Phone Programme (mean value 0.07V/m). For such symptoms **as sleep problems, depressions, cerebral symptoms, joint problems, infections, skin problems, cardiovascular problems as well as disorders of the visual and auditory systems and the gastrointestinal tract, a significant dose-response relationship was observed** in relation to objectively determined exposure levels. The impact of microwave radiation on the human nervous system serves as an explanation.

Carried out without outside funds, the study presented here provides a protocol concept that allows physicians and municipalities to cooperate and assess the potential human health impact of cell phone base stations located within residential areas.

30 Gómez-Perretta et al, 2013, BMJ Open. 2013 Dec 30;3(12)

Subjective symptoms related to GSM radiation from mobile phone base stations: a cross-sectional study.

<http://www.ncbi.nlm.nih.gov/pubmed/24381254>

OBJECTIVES:

We performed a re-analysis of the data from Navarro et al (2003) in which health symptoms related to microwave exposure from mobile phone base stations (BSs) were explored, including data obtained in a retrospective inquiry about fear of exposure from BSs.

DESIGN: Cross-sectional study.

SETTING: La Ñora (Murcia), Spain.

PARTICIPANTS:

Participants with known illness in 2003 were subsequently disregarded: 88 participants instead of 101 (in 2003) were analysed. Since weather circumstances can influence exposure, we restricted data to measurements made under similar weather conditions.

OUTCOMES AND METHODS:

A statistical method indifferent to the assumption of normality was employed: namely, binary logistic regression for modelling a binary response (eg, suffering fatigue (1) or not (0)), and so exposure was introduced as a predictor variable. This analysis was carried out on a regular basis and bootstrapping (95% percentile method) was used to provide more accurate CIs.

RESULTS:

The symptoms most related to exposure were lack of appetite (OR=1.58, 95% CI 1.23 to 2.03); lack of concentration (OR=1.54, 95% CI 1.25 to 1.89); irritability (OR=1.51, 95% CI 1.23 to 1.85); and trouble sleeping (OR=1.49, 95% CI 1.20 to 1.84). Changes in -2 log likelihood showed similar results. Concerns about the BSs were strongly related with trouble sleeping (OR =3.12, 95% CI 1.10 to 8.86). The exposure variable remained statistically significant in the multivariate analysis. The bootstrapped values were similar to asymptotic CIs.

CONCLUSIONS:

This study confirms our preliminary results. We observed that the incidence of most of the symptoms was related to exposure levels-independently of the demographic variables and some possible risk factors. Concerns about adverse effects from exposure, despite being strongly related with sleep disturbances, do not influence the direct association between exposure and sleep.

31 Hocking & Westerman, 2001, Occup Med (Lond). 2001 Sep;51(6):410-3.

Neurological abnormalities associated with CDMA exposure.

<http://www.ncbi.nlm.nih.gov/pubmed/11584121>

Dysaesthesiae of the scalp and neurological abnormality after mobile phone use have been reported previously, but the roles of the phone per se or the radiations in causing these findings have been questioned. We report finding a neurological abnormality in a patient after accidental exposure of the left side of the face to mobile phone radiation [code division multiple access (CDMA)] from a down-powered mobile phone base station antenna. **He had headaches, unilateral left blurred vision and pupil constriction, unilateral altered sensation on the forehead, and abnormalities of current perception thresholds on testing the left trigeminal ophthalmic nerve.** His nerve function recovered during 6 months follow-up. His exposure was 0.015-0.06 mW/cm(2) over 1-2 h. The implications regarding health effects of radiofrequency radiation are discussed.

32 Hutter et al, 2006, Occup Environ Med. 2006 May;63(5):307-13.

Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations

<http://www.ncbi.nlm.nih.gov/pubmed/16621850>

METHODS:

In a cross-sectional study of randomly selected inhabitants living in urban and rural areas for more than one year near to 10 selected base stations, 365 subjects were investigated. Several cognitive tests were performed, and wellbeing and sleep quality were assessed.

RESULTS:

Total HF-EMF and exposure related to mobile telecommunication were far below recommended levels (max. 4.1 mW/m²). Distance from antennae was 24-600 m in the rural area and 20-250 m in the urban area. Average power density was slightly higher in the rural area (0.05 mW/m²) than in the urban area (0.02 mW/m²).

Despite the influence of confounding variables, including fear of adverse effects from exposure to HF-EMF from the base station, there was a significant relation of some symptoms to measured power density; this was highest for headaches. Perceptual speed increased, while accuracy decreased insignificantly with increasing exposure levels. There was no significant effect on sleep quality.

CONCLUSION:

Despite very low exposure to HF-EMF, effects on wellbeing and performance cannot be ruled out, as shown by recently obtained experimental results; however, mechanisms of action at these low levels are unknown.

33 Khurana et al, 2010, Int J Occup Environ Health. 2010 Jul-Sep;16(3):263-7.

Epidemiological evidence for a health risk from mobile phone base stations.

<http://www.ncbi.nlm.nih.gov/pubmed/20662418>

By searching PubMed, we identified a total of 10 epidemiological studies that assessed for putative health effects of mobile phone base stations. Seven of these studies explored the association between base station proximity and neurobehavioral effects and three investigated cancer. **We found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. None of the studies reported exposure above accepted international guidelines, suggesting that current guidelines may be inadequate in protecting the health of human populations. We believe that comprehensive epidemiological studies of long-term mobile phone base station exposure are urgently required to more definitively understand its health impact.**

34 Kundi & Hutter, 2009, Pathophysiology. 2009 Aug;16(2-3):123-35.

Mobile phone base stations-Effects on wellbeing and health.

<http://www.ncbi.nlm.nih.gov/pubmed/19261451>

Studying effects of mobile phone base station signals on health have been discouraged by authoritative bodies like WHO International EMF Project and COST 281. WHO recommended studies around base stations in 2003 but again stated in 2006 that studies on cancer in relation to base station exposure are of low priority. As a result only few investigations of effects of base station exposure on health and wellbeing exist. **Cross-sectional investigations of**

subjective health as a function of distance or measured field strength, despite differences in methods and robustness of study design, found indications for an effect of exposure that is likely independent of concerns and attributions. Experimental studies applying short-term exposure to base station signals gave various results, but there is weak evidence that **UMTS and to a lesser degree GSM signals reduce wellbeing in persons that report to be sensitive to such exposures. Two ecological studies of cancer in the vicinity of base stations report both a strong increase of incidence within a radius of 350 and 400m respectively.** Due to the limitations inherent in this design no firm conclusions can be drawn, but the results underline the urgent need for a comprehensive investigation of this issue.

35 Navarro et al, 2003, Electromagn Biol Med 2003; 22 (2-3): 161 – 169

The Microwave Syndrome: A Preliminary Study in Spain.

<http://informahealthcare.com/doi/abs/10.1081/JBC-120024625>

A health survey was carried out in Murcia, Spain, in the vicinity of a Cellular Phone Base Station working in DCS-1800 MHz. This survey contained health items related to “microwave sickness” or “RF syndrome.” The microwave power density was measured at the respondents' homes. **Statistical analysis showed significant correlation between the declared severity of the symptoms and the measured power density. The separation of respondents into two different exposure groups also showed an increase of the declared severity in the group with the higher exposure.**

36 Oberfeld et al, 2004, Presented at Conference in Kos

The Microwave Syndrome – Further Aspects of a Spanish Study

http://www.powerwatch.org.uk/pdfs/20040809_kos.pdf

Questionnaire study of health effects with proximity to GSM base stations.

The strongest five associations found are depressive tendency, fatigue, sleeping disorder, difficulty in concentration and cardiovascular problems. The symptoms associated are in line with the symptoms reported in the literature as “Microwave Syndrome”. The odds ratios are quite high having small p values. Some kind of selection bias cannot be ruled out, because of the way the questionnaires were distributed, but that would affect more or less all cases and therefore affect the odds ratios not substantially.

Based on the data of this study the advice would be to strive for levels not higher than 0.02 V/m for the sum total, which is equal to a power density of 0.0001 $\mu\text{W}/\text{cm}^2$ or 1 $\mu\text{W}/\text{m}^2$, which is the indoor exposure value for GSM base stations proposed on empirical evidence by the Public Health Office of the Government of Salzburg in 2002.

37 Santini et al, 2003, Electromagn Biol Med 2003; 22 (1): 41 – 49

Survey study of people living in the vicinity of cellular phone base stations.

<http://informahealthcare.com/doi/abs/10.1081/JBC-120020353>

A survey study was conducted, using a questionnaire, on 530 people (270 men, 260 women) living or not in proximity to cellular phone base stations. Eighteen different symptoms (Non Specific Health Symptoms–NSHS), described as radiofrequency sickness, were studied by means of the chi-square test with Yates correction. The results that were obtained underline that certain complaints are experienced only in the immediate vicinity of base stations (up to 10 m for **nausea, loss of appetite, visual disturbances**), and others at greater distances from base stations (up to 100 m for irritability, depressive tendencies, lowering of libido, and up to 200 m for **headaches, sleep disturbances, feeling of discomfort**). In the 200 m to 300 m zone, only the complaint of **fatigue** is experienced significantly more often when compared with subjects residing at more than 300 m or not exposed (reference group). For seven of the studied symptoms and for the distance up to 300 m, **the frequency of reported complaints is significantly higher ($P < 0.05$) for women in comparison with men.** Significant differences are also observed in relation to the ages of subjects, and for the location of subjects in relation to the antennas and other electromagnetic factors.

38 Santini et al., 2002, Pathol Biol (Paris). 2002 Jul;50(6):369-73

Investigation on the health of people living near mobile telephone relay stations: I/Incidence according to distance and sex

<http://www.ncbi.nlm.nih.gov/pubmed/12168254>

A survey study using questionnaire was conducted in 530 people (270 men, 260 women) living or not in vicinity of cellular phone base stations, on 18 Non Specific Health Symptoms. Comparisons of complaints frequencies (CHI-SQUARE test with Yates correction) in relation with distance from base station and sex, **show significant ($p < 0.05$) increase as compared to people living > 300 m or not exposed to base station, till 300 m for tiredness, 200 m for headache, sleep disturbance, discomfort, etc. 100 m for irritability, depression, loss of memory, dizziness, libido sleep disturbance, depression, discomfort and visual perturbations. This first study on symptoms experienced by**

people living in vicinity of base stations shows that, in view of radioprotection, minimal distance of people from cellular phone base stations should not be < 300 m.

39 Shahbazi-Gahrouei et al, 2013, Electromagn Biol Med. 2013 Jun 19.

Health effects of living near mobile phone base transceiver station (BTS) antennae: a report from Isfahan, Iran.

<http://www.ncbi.nlm.nih.gov/pubmed/23781985>

Background: In recent years, by tremendous use of mobile phone telecommunication, a growing concern about the possible health hazards has increased greatly among public and scientists. **The mobile phone exposure has been shown to have many effects upon the immune functions, stimulating hormones, mammalian brain, sperm motility and morphology, and neurological pathologies syndrome.** The aim of this study was to find out the psychological and psychobiological reactions of the people who are living near mobile phone base transceiver stations (BTS) antenna, in Isfahan, Iran. Materials and methods: A cross-sectional study on 250 randomly selected inhabitants (133 women and 117 men) was performed in October 2012 till November 2012. The inhabitants were requested to complete a standardized questionnaire that focused on the relevant psychological and psychobiological reactions parameters. A computer program (SPSS version 16.0, Chicago, IL) was used for statistical analysis using the Chi-square test with Yates correction. All the data were tested using a criterion level of $p=0.05$. **Results: The results showed that most of the symptoms such as nausea, headache, dizziness, irritability, discomfort, nervousness, depression, sleep disturbance, memory loss and lowering of libido were statistically significant in the inhabitants living near the BTS antenna (<300 m distances) compared to those living far from the BTS antenna (>300 m).** Conclusion: It is suggested that cellular phone BTS antenna should not be sited closer than 300 m to populations to minimize exposure of neighbors.

40 Suleiman et al, 2014, GEP 2014; 2 : 77 – 83

Electromagnetic Radiation Health Effects in Exposed and Non-Exposed Residents in Penang. epidemiol.

<http://www.emf-portal.de/viewer.php?aid=25434&l=e>

A comparative study was conducted between residents exposed and not exposed to electromagnetic radiation (EMR) from TELCO towers in Penang Island with the objective of determining the possible health effects using 14 non-specific health symptoms (NSHS). Interviews on 201 respondents were conducted using structured questionnaire for demographic details, health related problems and the public concern. **Comparison of symptoms frequencies and its significance (Chi-square test) between the exposed and not exposed residents from the TELCO tower showed statistical significance ($p < 0.05$) for headache, giddiness, insomnia, loss of memory, diarrhea, mental slowness, reduced reaction time and mood swing.** The odds ratio for the development of the NSHS scored > 1 for all that gave a conclusion that respondents who were exposed were more likely to suffer symptoms as compared to the respondents who were not exposed to EMR. **This outcome showed that the existence of TELCO tower in these communities has detrimental health effects towards the residents who were exposed to the electromagnetic fields radiation that was emitted. Measures to be taken to minimize adverse health effects on residents should include imposing more stringent guidelines in terms of safety distance and radiation intensity, practicing of WHO precautionary approach, encouraging electromagnetic fields radiation related conference, researches and public awareness, sharing of transceivers by TELCO companies and using protective barriers. These steps will ultimately promote a healthier, harmonious and sustainable living environment.**

EHS GENERAL POPULATION SIGNS & SYMPTOMS – WI-FI:

41 Maganioti et al, 2010,

Wi-Fi electromagnetic fields exert gender related alterations on EEG.

6th International Workshop on Biological Effects of Electromagnetic fields.

The present data support the idea that Wi-Fi signal may influence normal physiology through changes in gender related cortical excitability, as reflected by alpha and beta EEG frequencies.

(The study found that Wi-Fi signals significantly decreased EEG electrical activity (alpha and beta frequencies) in cortical brain areas of young women whilst they were performing a short memory task.)

42 Papageorgiou et al, 2011, Journal of Integrative Neuroscience 10(2):189–202.

Effects of Wi-Fi signals on the p300 component of event-related potentials during an auditory hearing task.

<http://www.ncbi.nlm.nih.gov/pubmed/21714138>

The P300 component of event-related potentials (ERPs) is believed to index attention and working memory (WM) operation of the brain. The present study focused on the possible gender-related effects of Wi-Fi (Wireless Fidelity)

electromagnetic fields (EMF) on these processes. Fifteen male and fifteen female subjects, matched for age and education level, were investigated while performing a modified version of the Hayling Sentence Completion test adjusted to induce WM. ERPs were recorded at 30 scalp electrodes, both without and with the exposure to a Wi-Fi signal. P300 amplitude values at 18 electrodes were found to be significantly lower in the response inhibition condition than in the response initiation and baseline conditions. Independent of the above effect, within the response inhibition condition there was also a significant gender X radiation interaction effect manifested at 15 leads by decreased P300 amplitudes of males in comparison to female subjects only at the presence of EMF. In conclusion, **the present findings suggest that Wi-Fi exposure may exert gender-related alterations on neural activity associated with the amount of attentional resources engaged during a linguistic test adjusted to induce WM (Working Memory).**

[Exposure: 2.45 GHz; unspecified times; power 100mW, electric field strength 0.49 V/m (at subject's head)]

EHS GENERAL POPULATION SIGNS & SYMPTOMS - MOBILE PHONE EFFECTS:

See also Divan 2012¹⁴⁰, Sudan 2012¹⁴³.

43 Al-Khlaiwi & Meo, 2004, Saudi Med J. 2004 Jun;25(6):732-6.

Association of mobile phone radiation with fatigue, headache, dizziness, tension and sleep disturbance in Saudi population.

<http://www.ncbi.nlm.nih.gov/pubmed/15195201>

OBJECTIVE:

The widespread use of mobile phones has been increased over the past decade; they are now an essential part of business, commerce and society. The use of mobile phones can cause health problems. Therefore, the aim of the present study is to investigate the association of using mobile phones with fatigue, headache, dizziness, tension and sleep disturbance in the Saudi population and provide health and social awareness in using these devices.

METHODS:

This study was conducted in the Department of Physiology, College of Medicine, King Saud University, Riyadh, Kingdom of Saudi Arabia during the year 2002 to 2003. In the present study, a total of 437 subjects (55.1% male and 39.9% female) were invited, they have and had been using mobile phones. A questionnaire was distributed regarding detailed history and association of mobile phones with health hazards.

RESULTS:

The results of the present study showed an association between the use of mobile phones and health hazards. The overall mean percentage for these clinical findings in all groups were headache (21.6%), sleep disturbance (4%), tension (3.9%), fatigue (3%) and dizziness (2.4%).

CONCLUSION:

Based on the results of the present study, we conclude that the use of mobile phones is a risk factor for health hazards and suggest that long term or excessive use of mobile phones should be avoided by health promotion activities such as group discussions, public presentations and through electronic and print media sources.

[Exposure: mobile phone (frequency unspecified); duration of calls 5-10, 10-30, 30-60, 60-120 and >120 min and duration of exposure to mobile phone <1, 1-5 and 5-10 years; SAR unspecified]

44 Andrzejak R et al, 2008, Ind Health, 2008 Aug;46(4):409-17.

The influence of the call with a mobile phone on heart rate variability parameters in healthy volunteers.

<http://www.ncbi.nlm.nih.gov/pubmed/18716391>

It is possible that electromagnetic field (EMF) generated by mobile phones (MP) may have an influence on the autonomic nervous system (ANS) and modulates the function of circulatory system. The aim of the study was to estimate the influence of the call with a mobile phone on heart rate variability (HRV) in young healthy people. The time and frequency domain HRV analyses were performed to assess the changes in sympathovagal balance in a group of 32 healthy students with normal electrocardiogram (ECG) and echocardiogram at rest. The frequency domain variables were computed: ultra low frequency (ULF) power, very low frequency (VLF) power, low frequency (LF) power, high frequency (HF) power and LF/HF ratio was determined. ECG Holter monitoring was recorded in standardized conditions: from 08:00 to 09:00 in the morning in a sitting position, within 20 min periods: before the telephone call (period I), during the call with use of mobile phone (period II), and after the telephone call (period III). During 20 min call with a mobile phone time domain parameters such as standard deviation of all normal sinus RR intervals (SDNN [ms])--period I: 73.94+/-25.02, period II: 91.63+/-35.99, period III: 75.06+/-27.62; I-II: p<0.05, II-III: p<0.05) and standard deviation of the averaged normal sinus RR intervals for all 5-mm segments (SDANN [ms])--period I: 47.78+/-22.69, period II: 60.72+/-27.55, period III: 47.12+/-23.21; I-II: p<0.05, II-III: p<0.05) were significantly increased. As well as very

low frequency (VLF [ms2]--period I: 456.62+/-214.13, period II: 566.84+/-216.99, period III: 477.43+/-203.94; I-II: $p<0.05$), low frequency (LF [ms(2)]--period I: 607.97+/-201.33, period II: 758.28+/-307.90, period III: 627.09+/-220.33; I-II: $p<0.01$, II-III: $p<0.05$) and high frequency (HF [ms(2)]--period I: 538.44+/-290.63, period II: 730.31+/-445.78, period III: 590.94+/-301.64; I-II: $p<0.05$) components were the highest and the LF/HF ratio (period I: 1.48+/-0.38, period II: 1.16+/-0.35, period III: 1.46+/-0.40; I-II: $p<0.05$, II-III: $p<0.05$) was the lowest during a call with a mobile phone. The tone of the parasympathetic system measured indirectly by analysis of heart rate variability was increased while sympathetic tone was lowered during the call with use of a mobile phone. **It was shown that the call with a mobile phone may change the autonomic balance in healthy subjects. Changes in heart rate variability during the call with a mobile phone could be affected by electromagnetic field but the influence of speaking cannot be excluded.**

[Exposure: 1800 MHz (pulsed); continuous for 20 min; SAR 0.48 W/kg (tested by manufacturer)]

45 Chia et al, 2000, Environ Health Perspect. 2000 Nov;108(11):1059-62.

Prevalence of headache among handheld cellular telephone users in Singapore: a community study.

<http://www.ncbi.nlm.nih.gov/pubmed/11102297>

We carried out a cross-sectional community study in Singapore to determine the prevalence of specific central nervous system (CNS) symptoms among hand-held cellular telephone (HP) users compared to nonusers and to study the association of risk factors and CNS symptoms among HP users. A total of 808 men and women between 12 and 70 years of age, who lived in one community, were selected using one-stage cluster random sampling and responses to a structured questionnaire. The prevalence of HP users was 44.8%. **Headache was the most prevalent symptom among HP users compared to non-HP users**, with an adjusted prevalence rate ratio of 1.31 [95% confidence interval, 1.00-1.70]. **There is a significant increase in the prevalence of headache with increasing duration of usage (in minutes per day). Prevalence of headache was reduced by more than 20% among those who used hand-free equipment for their cellular telephones as compared to those who never use the equipment.** The use of HPs is not associated with a significant increase of CNS symptoms other than headache.

46 Chiu et al, 2014, J Formos Med Assoc. 2014 Aug 9. pii: S0929-6646(14)00207-1.

Mobile phone use and health symptoms in children.

<http://www.ncbi.nlm.nih.gov/pubmed/25115529>

BACKGROUND/PURPOSE:

To investigate the mobile phone (MP) use for talking in relation to health symptoms among 2042 children aged 11-15 years in Taiwan.

METHODS:

A nationwide, cross-sectional study, using the computer assisted telephone interview (CATI) technique, was conducted in 2009 to collect information on children's utilization of MPs and the perceived health symptoms reported by their parents.

RESULTS:

The overall prevalence of MP use in the past month was estimated at 63.2% [95% confidence interval (CI) = 61.1-65.3%]. **MP use was associated with a significantly increased adjusted odds ratio (AOR) for headaches and migraine (1.42, 95% CI = 1.12-1.81) and skin itches (1.84, 95% CI = 1.47-2.29). Children who regularly used MPs were also considered to have a health status worse than it was 1 year ago ($\beta = 0.27$, 95% CI = 0.17-0.37).**

CONCLUSION:

Although the cross-sectional design precludes the causal inference for the observed association, **our study tended to suggest a need for more cautious use of MPs in children**, because children are expected to experience a longer lifetime exposure to radiofrequency electromagnetic fields (RF-EMF) from MPs.

47 Hillert et al, 2008, Bioelectromagnetics. 2008 Apr;29(3):185-96.

The effects of 884 MHz GSM wireless communication signals on headache and other symptoms: an experimental provocation study.

<http://www.ncbi.nlm.nih.gov/pubmed/18044740>

Findings from prior studies of possible health and physiological effects from mobile phone use have been inconsistent. Exposure periods in provocation studies have been rather short and personal characteristics of the participants poorly defined. We studied the effect of radiofrequency field (RF) on self-reported symptoms and detection of fields after a prolonged exposure time and with a well defined study group including subjects reporting symptoms attributed to mobile phone use. The design was a double blind, cross-over provocation study testing a 3-h long GSM handset exposure versus sham. The study group was 71 subjects age 18-45, including 38 subjects reporting headache or vertigo in relation to mobile phone use (symptom group) and 33 non-symptomatic subjects. Symptoms were scored on a 7-

point Likert scale before, after 1(1/2) and 2(3/4) h of exposure. Subjects reported their belief of actual exposure status. **The results showed that headache was more commonly reported after RF exposure than sham, mainly due to an increase in the non-symptom group.** Neither group could detect RF exposure better than by chance. A belief that the RF exposure had been active was associated with skin symptoms. **The higher prevalence of headache in the non-symptom group towards the end of RF exposure justifies further investigation of possible physiological correlates.** The current study indicates a need to better characterize study participants in mobile phone exposure studies and differences between symptom and non-symptom groups.

48 Hocking, 1998, Occup Med (Lond). 1998 Sep;48(6):357-60.

Preliminary report: symptoms associated with mobile phone use.

<http://www.ncbi.nlm.nih.gov/pubmed/10024730>

Mobile phone use is ubiquitous, although the alleged health effects of low level radio-frequency radiation (RFR) used in transmission are contentious. Following isolated reports of headache-like symptoms arising in some users, a survey has been conducted to characterize the symptoms sometimes associated with mobile phone usage. A notice of interest in cases was placed in a major medical journal and this was publicized by the media. Respondents were interviewed by telephone using a structured questionnaire. **Forty respondents from diverse occupations described unpleasant sensations such as a burning feeling or a dull ache mainly occurring in the temporal, occipital or auricular areas. The symptoms often began minutes after beginning a call, but could come on later during the day. The symptoms usually ceased within an hour after the call, but could last until evening. Symptoms did not occur when using an ordinary handset, and were different from ordinary headaches. There were several reports suggestive of intra-cranial effects. Three respondents reported local symptoms associated with wearing their mobile phone on their belts.** There was one cluster of cases in a workplace. Seventy-five per cent of cases were associated with digital mobile phones. Most of the respondents obtained relief by altering their patterns of telephone usage or type of phone. **Cranial and other diverse symptoms may arise associated with mobile phone usage. Physicians and users alike should be alert to this.** Further work is needed to determine the range of effects, their mechanism and the possible implications for safety limits of RFR.

49 Ikeda et al, 2014, Environ Health Prev Med. 2014 May;19(3):187-93.

Association between mobile phone use and depressed mood in Japanese adolescents: a cross-sectional study.

<http://www.ncbi.nlm.nih.gov/pubmed/24347468>

OBJECTIVES:

Mobile phones are commonly used by adolescents. The aim of this study was to clarify associations between duration of mobile phone use and psychological mood in high school students.

METHODS:

This cross-sectional study included 2,785 high school students in Niigata, Japan. A self-administered questionnaire was used to elicit information on sex, school year, hours of mobile phone use, psychological mood status, and possible confounders. Psychological mood outcomes were evaluated with the Mood Inventory, developed and validated in 1994, which includes five subcomponents with total scores ranging from 8 to 32 (higher score indicates stronger feeling): "Tension and excitement," "Refreshing mood," "Fatigue," "Depressed mood," and "Anxious mood." Analysis of covariance with Bonferroni's multiple comparison was used to compare mean values among quartiles of hours of mobile phone use.

RESULTS:

Among the respondents, mean mobile phone use per week was 24 (median 18) h. Long-duration mobile phone use was associated with female students, no participation in sports club activities, early mobile phone use, and fewer hours spent sleeping (all $P < 0.001$). Overall associations between hours of mobile phone use and total scores were significant for "Depressed mood" (P for trend = 0.005), "Tension and excitement" (P for trend < 0.001), and "Fatigue" (P for trend < 0.001). Total scores for "Depressed mood," "Tension and excitement," and "Fatigue" of the fourth quartile (≥ 33 h/week) of mobile phone use were significantly higher than for other quartiles (all $P < 0.05$).

CONCLUSIONS:

Increased duration of mobile phone use is associated with unfavorable psychological mood, in particular, a depressed mood. Decreasing mobile phone use may help maintain appropriate mental health in very long-duration users.

50 Khan, 2008, Int J Occup Med Environ Health. 2008;21(4):289-93.

Adverse effects of excessive mobile phone use.

<http://www.ncbi.nlm.nih.gov/pubmed/19228576>

INTRODUCTION:

Research findings indicate that the use of mobile phones may lead to a number of symptoms such as headache, impaired concentration and memory, and also fatigue.

MATERIALS AND METHODS:

The present study was designed to investigate whether the symptoms of ill health reported by young people may be associated with the use of mobile phone (MP) and to analyze its influence on health and development of medical students. The questionnaire was designed specifically for this study and contained items regarding health condition and health complaints as well as the frequency of MP use. The response rate was 86.6% (286 of 330 forms, completed by 73.77% males and 26.22% females).

RESULTS:

Most of the subjects (83.57%) had some knowledge about the adverse effects of MP use. 76.92% of the students carried one mobile, and 23.08% more than one. 55.94%, of the subjects reported the average daily MP use of less than 30 min, 27.97%, of 30-60 min, 11.53%, of 60-90 min and 4.54% of more than 90 min. 16.08% of the subjects complained of headache and 24.48% of fatigue. **Impaired concentration was reported by 34.27% of respondents, memory disturbances by 40.56%, sleeplessness by 38.8%, hearing problems by 23.07%, and facial dermatitis by 16.78%. The sensation of warmth within the auricle and behind/around the ear was reported by 28.32%. Out of 286 subjects who participated in this study, 44.4% related their symptoms to mobile phone use.**

CONCLUSIONS:

The findings of the present study indicate that mobile phones play a large part in the daily life of medical students. Therefore, its impact on psychology and health should be discussed among the students to prevent the harmful effects of mobile phone use.

[Exposure: mobile phone (frequency unspecified); daily mobile phone use <30, 30-60, 60-90 and >90 min/day; SAR unspecified]

51 Khorseva et al, 2011, Radiats Biol Radioecol. 2011 Sep-Oct;51(5):617-23.

Psychophysiological indicators for children using mobile phones. Communication 2. Results of four-year monitoring
<http://www.ncbi.nlm.nih.gov/pubmed/22279774>

This study submits the results of a four-year monitoring of a complex diagnostics of the psychophysiological indicators for 196 children aged 7 to 12 years old: 147 of them are child users of mobile communication (test group) and 49 are in the control group. **We have identified the following major trends of the psychophysiological indicators for child users of mobile communication: an increased number of phonemic perception disorders, abatement of efficiency, reduced indicators for the arbitrary and semantic memory, an increased fatigue. A steady decline of the parameters from high values to bottom standards has been found.**

52 Khullar et al, 2013, Indian J Otolaryngol Head Neck Surg. 2013 Dec;65(Suppl 3):645-9

Auditory Brainstem Responses and EMFs Generated by Mobile Phones.

<http://www.ncbi.nlm.nih.gov/pubmed/24427730?dopt=Abstract>

There has been a manifold increase in the number of mobile phone users throughout the world with the current number of users exceeding 2 billion. However this advancement in technology like many others is accompanied by a progressive increase in the frequency and intensity of electromagnetic waves without consideration of the health consequences. The aim of our study was to advance our understanding of the potential adverse effects of GSM mobile phones on auditory brainstem responses (ABRs). 60 subjects were selected for the study and divided into three groups of 20 each based on their usage of mobile phones. Their ABRs were recorded and analysed for latency of waves I-V as well as interpeak latencies I-III, I-V and III-V (in ms). Results revealed no significant difference in the ABR parameters between group A (control group) and group B (subjects using mobile phones for maximum 30 min/day for 5 years). **However the latency of waves was significantly prolonged in group C (subjects using mobile phones for 10 years for a maximum of 30 min/day) as compared to the control group. Based on our findings we concluded that long term exposure to mobile phones may affect conduction in the peripheral portion of the auditory pathway.** However more research needs to be done to study the long term effects of mobile phones particularly of newer technologies like smart phones and 3G.

[Exposure: mobile phone RF (unspecified frequency)]

53 Küçer & Pamukçu, 2014, Electromagn Biol Med. 2014 Jan;33(1):15-7.

Self-reported symptoms associated with exposure to electromagnetic fields: a questionnaire study.

<http://www.ncbi.nlm.nih.gov/pubmed/23730819>

In the last years, it has been discussed frequently whether there are any harmful effects of electromagnetic fields on human health. Electromagnetic fields are generated by several natural and man-made sources. Part of the electromagnetic spectrum called Radiofrequency is used in communication systems such as mobile (cellular) phone and

computer. The aim of our study was to explore different self-reported symptoms that may be associated with exposure to electromagnetic fields. This survey study was conducted, using a questionnaire, on 350 people aged +9 years in Turkey. The chi-square test was used for data analysis. **Self-reported symptoms were headache, vertigo/dizziness, fatigue, forgetfulness, sleep disturbance-insomnia, tension-anxiety, joint and bone pain, lacrimation of the eyes, hearing loss and tinnitus.** As a result of the survey, the study has shown that **users of mobile phone and computer more often complained of headache, joint and bone pain, hearing loss, vertigo/dizziness, tension-anxiety symptoms according to time of daily usage ($p < 0.05$). In users of mobile phone and computer, women significantly ($p < 0.05$) complained more often of headache, vertigo/dizziness, fatigue, forgetfulness and tension-anxiety than men.**

54 Lowden et al, 2011, Bioelectromagnetics. 2011 Jan;32(1):4-14.

Sleep after mobile phone exposure in subjects with mobile phone-related symptoms.

<http://www.ncbi.nlm.nih.gov/pubmed/20857453>

<http://www.emf-portal.de/viewer.php?aid=18633&l=e>

Several studies show increases in activity for certain frequency bands (10-14 Hz) and visually scored parameters during sleep after exposure to radiofrequency electromagnetic fields. A shortened REM latency has also been reported. We investigated the effects of a double-blind radiofrequency exposure (884 MHz, GSM signaling standard including non-DTX and DTX mode, time-averaged 10 g psSAR of 1.4 W/kg) on self-evaluated sleepiness and objective EEG measures during sleep. Forty-eight subjects (mean age 28 years) underwent 3 h of controlled exposure (7:30-10:30 PM; active or sham) prior to sleep, followed by a full-night polysomnographic recording in a sleep laboratory. The results demonstrated that following exposure, time **in Stages 3 and 4 sleep (SWS, slow-wave sleep) decreased by 9.5 min (12%) out of a total of 78.6 min, and time in Stage 2 sleep increased by 8.3 min (4%) out of a total of 196.3 min compared to sham. The latency to Stage 3 sleep was also prolonged by 4.8 min after exposure. Power density analysis indicated an enhanced activation in the frequency ranges 0.5-1.5 and 5.75-10.5 Hz during the first 30 min of Stage 2 sleep, with 7.5-11.75 Hz being elevated within the first hour of Stage 2 sleep, and bands 4.75-8.25 Hz elevated during the second hour of Stage 2 sleep.** No pronounced power changes were observed in SWS or for the third hour of scored Stage 2 sleep. No differences were found between controls and subjects with prior complaints of mobile phone-related symptoms. The results confirm previous findings that **RF exposure increased the EEG alpha range in the sleep EEG, and indicated moderate impairment of SWS (slow-wave sleep).** Furthermore, reported differences in sensitivity to mobile phone use were not reflected in sleep parameters.
[Exposure: 884 MHz (amplitude modulation pulsed); continuous for 3 hr; SAR 1.4 W/kg average over time (10g), 1.95 W/kg peak value (10g) during non-GSM-DTX mode, 1.8 W/kg peak value (1g) gray matter, 0.2 W/kg spatial average (1g) gray matter, 0.18 W/kg spatial average (1g) thalamus]

55 Maby E et al, 2006, Conf Proc IEEE Eng Med Biol Soc. 2006;1:3751-4.

Short-term effects of GSM mobile phones on spectral components of the human electroencephalogram

<http://www.ncbi.nlm.nih.gov/pubmed/17946579>

The aim of the study was to investigate whether the GSM (global system for mobile) signals affect the electrical activity of the human brain. Nine healthy subjects and six temporal epileptic patients were exposed to radiofrequencies emitted by a GSM mobile phone signals. Electroencephalographic (EEG) signals were recorded using surface electrodes with and without radiofrequency. In order to obtain a reference, a control session was also carried out. The spectral attributes of the EEG signals recorded by surface electrodes were analyzed. The significant decrease of spectral correlation coefficients under radiofrequency influence **showed that the GSM signal altered the spectral arrangement of the EEG activity for healthy subjects as well as epileptic patients.** For the healthy subjects, the EEG spectral energy decreased on the studied frequency band [0-40 Hz] and more precisely on occipital electrodes for the alpha-band. For the epileptic patients, these modifications were demonstrated by an increase of the power spectral density of the EEG signal. Nevertheless, these biological effects on the EEG are not sufficient to put forward some electrophysiological hypothesis.

[Exposure: mobile phone 900 MHz (pulsed)]

56 Maier et al, 2004, Acta Neurol Scand. 2004 Jul;110(1):46-52.

Effects of pulsed electromagnetic fields on cognitive processes - a pilot study on pulsed field interference with cognitive regeneration.

<http://www.ncbi.nlm.nih.gov/pubmed/15180806>

BACKGROUND:

Due to the ubiquitous use of cellular phones much has been speculated on secondary effects of electromagnetic irradiation emitted by those. Additionally, several studies have reported vegetative alterations as well as effects on the

neuronal and molecular levels in humans. Here, using a psycho-physiological test paradigm, we examined effects of exposure to pulsed electromagnetic fields on cognitive performance.

MATERIALS AND METHODS:

In 11 volunteers, we tested cognitive processing under field exposure (GSM standard) and under field-free conditions. To examine the hypothesized effect of pulsed fields, we applied an auditory discrimination task and determined the participant's current 'Order Threshold' value. Following a first test cycle, the volunteers had to relax for 50 min while being, or not, exposed to pulsed electromagnetic fields. Subsequently, the test was repeated. Data acquired before and after the resting phase were compared from both experimental conditions.

RESULTS:

We found that nine of the 11 test participants (81.8%) showed worse results in their auditory discrimination performance upon field exposure as compared with control conditions. Group data comparison revealed a statistical significance of $P = 0.0105$.

CONCLUSION:

We could show that the participants' cognitive performance was impaired after exposure to pulsed electromagnetic fields. With regard to this finding, we recommend that the use of cellular phones should be restricted generally and in particular in respect of physical hazard of high-risk groups, e.g. elderly, children and ill people.

[Exposure: mobile phone 902 MHz (pulsed); continuous for 50 min; power flux density 1 mW/m² (manufacturer's information, distance unspecified)]

57 Mortazavi et al, 2011, Iran J Med Sci. 2011 Jun;36(2):96-103.

The pattern of mobile phone use and prevalence of self-reported symptoms in elementary and junior high school students in Shiraz, Iran.

<http://www.ncbi.nlm.nih.gov/pubmed/23358105>

BACKGROUND:

The use of mobile phone by children is increasing drastically. Children are likely to accumulate many years of exposure during their lives. Furthermore, as nervous systems in children are developing, children may be at a greater risk compared to adults. In this light, some scientists have suggested that the use of mobile phones should be restricted in high-risk groups such as children. This study is an attempt to explore the pattern of mobile phone use and its health effects among students from the city of Shiraz, Iran.

METHODS:

A total of 469 (235 males and 234 females; 250 elementary and 219 junior high school) healthy students participated in this study. The students were randomly selected from three different educational districts of the city. For each student, a questionnaire regarding the possible sources of exposure to electromagnetic fields or microwave radiation, specially the pattern of mobile phone use, medical history and life style was filled out by interviewers.

RESULTS:

Only 31.42% of the students used to use mobile phones. The average daily time of using mobile phones in talk mode was 7.08 ± 21.42 minutes. Not only the relative frequency of mobile phone ownership in boys was significantly more than the girls, but also the boys used their mobile phones more frequently. **Statistically significant associations were found between the time mobile phones were used in talk mode and some symptoms. Furthermore, a statistically significant association was found between the time mobile phones were used in talk mode and the number of headaches per month, number of vertigo per month, or number of sleeping problem per month.**

CONCLUSION:

Results obtained in this study show that a large proportion of children in the city of Shiraz use mobile phones. **A significant increase was found in some self-reported symptoms among users of mobile phones. These findings are in line with what is widely believed regarding the higher vulnerability of children to exhibit symptoms from using mobile phones.** The findings and conclusion of the present study should be viewed in the light the nature of symptoms measurement (self-report) and the knowledge and understandings of the participants about the symptoms.

58 Munezawa et al, 2011, Sleep. 2011 Aug 1;34(8):1013-20.

The association between use of mobile phones after lights out and sleep disturbances among Japanese adolescents: a nationwide cross-sectional survey.

<http://www.ncbi.nlm.nih.gov/pubmed/21804663>

STUDY OBJECTIVE:

The objective of this study was to examine the association between the use of mobile phones after lights out and sleep disturbances among Japanese adolescents.

DESIGN AND SETTING:

This study was designed as a cross-sectional survey. The targets were students attending junior and senior high schools throughout Japan. Sample schools were selected by cluster sampling. Self-reported anonymous questionnaires were sent to schools for all students to fill out.

PARTICIPANTS:

A total of 95,680 adolescents responded. The overall response rate was 62.9%, and 94,777 questionnaires were subjected to analysis.

INTERVENTION:

N/A.

MEASUREMENTS AND RESULTS:

Daily mobile phone use, even if only for a brief moment every day, was reported by 84.4%. Moreover, as for use of mobile phones after lights out, 8.3% reported using their mobile phone for calling every day and 17.6% reported using it for sending text messages every day. **Multiple logistic regression analysis showed that mobile phone use for calling and for sending text messages after lights out was associated with sleep disturbances (short sleep duration, subjective poor sleep quality, excessive daytime sleepiness, and insomnia symptoms) independent of covariates and independent of each other.**

CONCLUSION:

This study showed that the use of mobile phones for calling and for sending text messages after lights out is associated with sleep disturbances among Japanese adolescents. However, there were some limitations, such as small effect sizes, in this study. More studies that examine the details of this association are necessary to establish strategies for sleep hygiene in the future.

59 Oftedal et al, 2000, Occup Med (Lond). 2000 May;50(4):237-45.

Symptoms experienced in connection with mobile phone use.

<http://www.ncbi.nlm.nih.gov/pubmed/10912374>

Many people in Norway and Sweden reported headaches, fatigue, and other symptoms experienced in connection with the use of a mobile phone (MP). Therefore, we initiated a cross-sectional epidemiological study among 17,000 people, all using an MP in their job. Thirty-one percent of the respondents in Norway and 13% of those in Sweden had experienced at least one symptom in connection with MP use. **Next to the sensations of warmth on the ear and behind/around the ear, burning sensations in the facial skin and headaches were most commonly reported. Most symptoms usually began during or within half an hour after the call and lasted for up to 2 h.** Relatively few had consulted a physician or been on sick leave because of the symptoms, **but about 45% among those with an MP attributed symptom had taken steps to reduce the symptom.** These results suggest an awareness of the symptoms, but not necessarily a serious health problem.

60 Oktay & Dasdag, 2006, Electromagn Biol Med. 2006;25(1):13-21.

Effects of intensive and moderate cellular phone use on hearing function.

<http://www.ncbi.nlm.nih.gov/pubmed/16595330>

The purpose of this study is to investigate the effects of radiation emitted by mobile phones on the hearing of users. The study was carried out on three groups: 1) 20 men who have used a cellular phone frequently and spoken approximately 2 h per day for four years; 2) 20 men who have used a cellular phone for 10-20 min per day for four years; and 3) 20 healthy men who have never used a cellular phone (the control group). Brainstem evoked response audiometric (BERA) and pure tone audiometric (PTA) methods were used to measure the effects of exposure on hearing function of the subjects. In BERA measurements, I-III, III-V, and I-V interpeak latencies were evaluated. Interpeak latency of subjects in two experimental groups was compared to that of subjects in the control group. The BERA results showed no differences among the groups ($p > 0.05$). In PTA measurements, detection thresholds at 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, and 8000 Hz frequencies were measured in all three groups. No differences were observed between moderate mobile phone users (10-20 min. per day) and control subjects. However, **detection thresholds in those who talked approximately 2 h per day were found to be higher than those in either moderate users or control subjects.** Differences at 4000 Hz for both bone and air conduction for right ears, and 500 Hz, and 4000 Hz bone and air conduction for left ears were significant for mean hearing threshold. **This study shows that a higher degree of hearing loss is associated with long-term exposure to electromagnetic (EM) field generated by cellular phones.**

61 Redmayne et al, 2013, Environ Health. 2013 Oct 22;12(1):90.

The relationship between adolescents' well-being and their wireless phone use: a cross-sectional study.

<http://www.ncbi.nlm.nih.gov/pubmed/24148357>

The exposure of young people to radiofrequency electromagnetic fields (RF-EMFs) has increased rapidly in recent years with their increased use of cellphones and use of cordless phones and WiFi. We sought to ascertain associations between New Zealand early-adolescents' subjective well-being and self-reported use of, or exposure to, wireless telephone and internet technology.

METHODS:

In this cross-sectional survey, participants completed questionnaires in class about their cellphone and cordless phone use, their self-reported well-being, and possible confounding information such as whether they had had influenza recently or had a television in the bedroom. Parental questionnaires provided data on whether they had WiFi at home and cordless phone ownership and model. Data were analysed with Ordinal Logistic Regression adjusting for common confounders. Odds ratios (OR) and 95% confidence intervals were calculated.

RESULTS:

The number and duration of cellphone and cordless phone calls were associated with **increased risk of headaches** (>6 cellphone calls over 10 minutes weekly, adjusted OR 2.4, CI 1.2-4.8; >15 minutes cordless use daily adjusted OR 1.74, CI 1.1-2.9)). Texting and extended use of wireless phones was related to having a **painful 'texting' thumb**). Using a wired cellphone headset was associated with **tinnitus** (adjusted OR 1.8, CI 1.0-3.3), while wireless headsets were associated with **headache** (adjusted OR 2.2, CI 1.1-4.5), **feeling down/depressed** (adjusted OR 2.0, CI 1.1-3.8), and **waking in the night** (adjusted OR 2.4, CI 1.2-4.8). Several cordless phone frequencies bands were related to **tinnitus, feeling down/depressed and sleepiness** at school, while the last of these was also related to modulation. Waking nightly was less likely for those with WiFi at home (adjusted OR 0.7, CI 0.4-0.99). Being woken at night by a cellphone was strongly related to tiredness at school (OR 4.1, CI 2.2-7.7).

CONCLUSIONS:

There were more statistically significant associations (36%) than could be expected by chance (5%). Several were dose-dependent relationships. To safeguard young people's well-being, we suggest limiting their use of cellphones and cordless phones to less than 15 minutes daily, and employing a speaker-phone device for longer daily use. We recommend parental measures are taken to prevent young people being woken by their cellphones.

62 Regel et al, 2007, J Sleep Res. 2007 Sep;16(3):253-8.

Pulsed radio-frequency electromagnetic fields: dose-dependent effects on sleep, the sleep EEG and cognitive performance.

<http://www.ncbi.nlm.nih.gov/pubmed/17716273>

To establish a dose-response relationship between the strength of electromagnetic fields (EMF) and previously reported effects on the brain, we investigated the influence of EMF exposure by varying the signal intensity in three experimental sessions. The head of 15 healthy male subjects was unilaterally exposed for 30 min prior to sleep to a pulse-modulated EMF (GSM handset like signal) with a 10 g-averaged peak spatial specific absorption rate of (1) 0.2 W kg⁻¹, (2) 5 W kg⁻¹, or (3) sham exposed in a double-blind, crossover design. During exposure, subjects performed two series of three computerized cognitive tasks, each presented in a fixed order [simple reaction time task, two-choice reaction time task (CRT), 1-, 2-, 3-back task]. Immediately after exposure, night-time sleep was polysomnographically recorded for 8 h. Sleep architecture was not affected by EMF exposure. **Analysis of the sleep electroencephalogram (EEG) revealed a dose-dependent increase of power in the spindle frequency range in non-REM sleep. Reaction speed decelerated with increasing field intensity in the 1-back task, while accuracy in the CRT and N-back task were not affected in a dose-dependent manner. In summary, this study reveals first indications of a dose-response relationship between EMF field intensity and its effects on brain physiology as demonstrated by changes in the sleep EEG and in cognitive performance.**

[Exposure: 900 MHz (pulsed); continuous for 30 min; SAR 0.2 and 5 W/kg average over mass (10g)]

63 Salama et al, 2004, J Egypt Public Health Assoc. 2004;79(3-4):197-223.

Cellular phones: are they detrimental?

<http://www.ncbi.nlm.nih.gov/pubmed/16918147>

The issue of possible health effects of cellular phones is very much alive in the public's mind where the rapid increase in the number of the users of cell phones in the last decade has increased the exposure of people to the electromagnetic fields (EMFs). Health consequences of long term use of mobile phones are not known in detail but available data indicates the development of non specific annoying symptoms on acute exposure to mobile phone radiations. In an attempt to determine the prevalence of such cell phones associated health manifestations and the factors affecting their occurrence, a cross sectional study was conducted in five randomly selected faculties of Alexandria University. Where, 300 individuals including teaching staff, students and literate employee were equally allocated and randomly selected among the five faculties. Data about mobile phone's users and their medical history, their pattern of mobile usage and the possible deleterious health manifestations associated with cellular phone use was collected. **The results**

revealed 68% prevalence of mobile phone usage, nearly three quarters of them (72.5%) were complainers of the health manifestations. They suffered from headache (43%), earache (38.3%), sense of fatigue (31.6%), sleep disturbance (29.5%), concentration difficulty (28.5%) and face burning sensation (19.2%). Both univariate and multivariate analysis were consistent in their findings. Symptomatic users were found to have significantly higher frequency of calls/day, longer call duration and longer total duration of mobile phone usage/day than non symptomatic users. **For headache both call duration and frequency of calls/day were the significant predicting factors for its occurrence ($\chi^2 = 18.208$, $p = 0.0001$). For earache, in addition to call duration, the longer period of owning the mobile phone were significant predictors ($\chi^2 = 16.996$, $p = 0.0002$).** Sense of fatigue was significantly affected by both call duration and age of the user ($\chi^2 = 24.214$, $p = 0.0000$), while burning sensation was only affected by frequency of calls/day ($\chi^2 = 5.360$, $p = 0.020$). According to the 95% confidence interval of frequency and duration of calls, **the study recommended not to increase the call duration more than four minutes and limit their frequency to less than seven calls/day with total duration of exposure less than 22 min./day.**

64 Santini et al, 2001, Pathol Biol (Paris). 2001 Apr;49(3):222-6.

Symptoms reported by mobile cellular telephone users. [Article in French]

<http://www.ncbi.nlm.nih.gov/pubmed/11367556>

A survey study, using questionnaire, was conducted in 161 students and workers in a French engineering school on symptoms experienced during use of digital cellular phones. **A significant increase in concentration difficulty ($p < 0.05$) was reported by users of 1800-MHz (DCS) cellular phones compared to 900-MHz (GSM) phone users. In users of cellular phones, women significantly ($p < 0.05$) complained more often of sleep disturbance than men. This sex difference for sleep complaint is not observed between women and men non-users of cellular phone. The use of both cellular phones and VDT significantly ($p < 0.05$) increased concentration difficulty. Digital cellular phone users also significantly ($p < 0.05$) more often complained of discomfort, warmth, and picking on the ear during phone conversation in relation with calling duration per day and number of calls per day. The complaint of warmth on the ear might be a signal to users for stopping the call.**

65 Schmid et al, 2012, J Sleep Res. 2012 Feb;21(1):50-8.

Sleep EEG alterations: effects of different pulse-modulated radio frequency electromagnetic fields.

<http://www.ncbi.nlm.nih.gov/pubmed/21489004>

<http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2869.2011.00918.x/pdf> (full paper)

Previous studies have observed increases in electroencephalographic power during sleep in the spindle frequency range (approximately 11-15 Hz) after exposure to mobile phone-like radio frequency electromagnetic fields (RF EMF). Results also suggest that pulse modulation of the signal is crucial to induce these effects. Nevertheless, it remains unclear which specific elements of the field are responsible for the observed changes. We investigated whether pulse-modulation frequency components in the range of sleep spindles may be involved in mediating these effects. Thirty young healthy men were exposed, at weekly intervals, to three different conditions for 30 min directly prior to an 8-h sleep period. Exposure consisted of a 900-MHz RF EMF, pulse modulated at 14Hz, and a sham control condition. Both active conditions had a peak spatial specific absorption rate of 2 W kg⁻¹. During exposure subjects performed three different cognitive tasks (measuring attention, reaction speed and working memory), which were presented in a fixed order. **Electroencephalographic power in the spindle frequency range was increased during non-rapid eye movement sleep (2nd episode) following the 14-Hz pulse-modulated condition. A similar but non-significant increase was also observed following the 217-Hz pulse-modulated condition. Importantly, this exposure-induced effect showed considerable individual variability.** Regarding cognitive performance, no clear exposure-related effects were seen. **Consistent with previous findings, our results provide further evidence that pulse-modulated RF EMF alter brain physiology, although the time-course of the effect remains variable across studies. Additionally, we demonstrated that modulation frequency components within a physiological range may be sufficient to induce these effects.**

[Exposure: 900 MHz (pulsed); continuous for 30 min; SAR 2 W/kg peak value (10g)]

66 Söderqvist et al, 2008, Environ Health. 2008 May 21;7:18. doi: 10.1186/1476-069X-7-18.

Use of wireless telephones and self-reported health symptoms: a population-based study among Swedish adolescents aged 15-19 years.

<http://www.ncbi.nlm.nih.gov/pubmed/18495003>

RESULTS:

The questionnaire was answered by 63.5% of the study subjects. Most participants reported access to a mobile phone (99.6%) and use increased with age; 55.6% of the 15-year-olds and 82.2% of the 19-year-olds were regular users. Girls generally reported more frequent use than boys. Use of wired hands-free equipment 'anytime' was reported by 17.4%.

Cordless phones were used by 81.9%, and 67.3% were regular users. Watching TV increased the odds ratio for use of wireless phones, adjusted for age and gender. Some of the most frequently reported health complaints were **tiredness, stress, headache, anxiety, concentration difficulties and sleep disturbances. Regular users of wireless phones had health symptoms more often and reported poorer perceived health than less frequent users.**

CONCLUSION:

Almost all adolescence in this study used a wireless phone, girls more than boys. The most frequent use was seen among the older adolescents, and those who watched TV extensively. The study further showed that perceived health and **certain health symptoms seemed to be related to the use of wireless phones.** However, this part of the investigation was explorative and should therefore be interpreted with caution since bias and chance findings due to multiple testing might have influenced the results. Potentially this study will stimulate more sophisticated studies that may also investigate directions of associations and whether, or to what degree, any mediation factors are involved.

67 Szyjowska et al, 2014, Int J Occup Med Environ Health. 2014 Apr;27(2):293-303.

The risk of subjective symptoms in mobile phone users in Poland--an epidemiological study.

<http://www.ncbi.nlm.nih.gov/pubmed/24692074>

OBJECTIVES:

To assess the type and incidence of subjective symptoms related to the use of mobile phones in Polish users.

MATERIAL AND METHODS:

The study was conducted in 2005 using a questionnaire survey. Although it has been quite a long time, up to now, no such data have been published for Poland. The questionnaire consisted of 53 questions concerning sex, age, education, general health, characteristics of a mobile phone (hand-held, loud-speaking unit) as well as the habits associated with its use (frequency and duration of calls, text messages, etc.) and complaints associated with using a mobile phone.

RESULTS:

As many as 1800 questionnaires were sent. The response was obtained from 587 subjects aged 32.6 ± 11.3 (48.9% women, 51.1% men); the age did not differ significantly between men and women. The subjects owned a cell phone for an average of 3 years. Majority of the respondents used the phone intensively, i.e. daily (74%) or almost daily (20%).

Headaches were reported significantly more often by the people who talked frequently and long in comparison with other users (63.2% of the subjects, $p = 0.0029$), just like the symptoms of fatigue (45%, $p = 0.013$). Also, the feeling of warmth around the ear and directly to the auricle was reported significantly more frequently by the intensive mobile phone users, compared with other mobile phone users (47.3%, $p = 0.00004$ vs. 44.6%, $p = 0.00063$, respectively). Most symptoms appeared during or immediately after a call and disappeared within 2 h after the call. Continuous headache, persisting for longer than 6 h since the end of a call, was reported by 26% of the subjects.

CONCLUSIONS:

Our results show that the mobile phone users may experience subjective symptoms, the intensity of which depends on the intensity of use of mobile phones.

68 Szyjowska et al, 2005, Pol Merkur Lekarski. 2005 Oct;19(112):529-32.

Subjective symptoms related to mobile phone use--a pilot study. [Article in Polish]

<http://www.ncbi.nlm.nih.gov/pubmed/16379318>

Research findings indicate that the use of mobile phones may lead to a number of symptoms such as headache, impaired concentration and memory, fatigue. In Poland this problem has not as yet been addressed by scientific studies.

THE AIM:

The present project was undertaken to investigate whether the symptoms of ill health reported by young people may be associated with the use of mobile phone.

MATERIAL AND METHODS:

A survey using a self-reported questionnaire was conducted among randomly selected university students in Lodz, Central Poland. The questionnaire was designed specifically for this study and contained items on health condition and complaints as well as on frequency of mobile phone use. The number of questionnaires necessary for the study was assessed using the simple random sample method. Out of the 160 copies distributed among the students, 140 (87.5%) were completed. Eventually, 117 questionnaires were subject to analysis; the data from respondents who reported health problems (neck trauma in a car accident, chronic sinusitis and arterial hypertension) were excluded. The following statistical methods were used to analyse questionnaire data: t-Student test for equal and unequal variances or F-Snedecor test for comparing parameters in two study groups, Fisher exact test for comparing frequency, and single and multiple logistic regression models for quantitative risk assessment of negative health outcomes in relation to exposure level and with control for confounders. The subjects were 61 (52.1%) males and 56 females (47.9%).

RESULTS:

Most of the subjects (62%) assessed their health condition as good, 31% as very good and 7% as fair. 70% complained of headache and 20% of dizziness. Impaired concentration occurred in 56% of respondents. Facial dermatitis was reported by 11%. The most prevalent symptom related to mobile phone use was the thermal sensation within the auricle and behind/around the ear. This was reported by 33 subjects (28.2%). Out of 82 subjects who complained of headache, only 8 (6.8%) related this symptom to mobile phone use. **Only 10 subjects of 65 reporting impaired concentration thought it could be associated with their using a mobile phone.** The symptoms and health complaints reported by the respondents in no case were the reason for a medical check-up or taking any medication.

CONCLUSIONS:

The large number of young people complaining of headache and impaired concentration calls for further research to investigate the underlying reasons. It cannot be excluded that one of them may be exposure to EMF emitted by mobile phone. The explanation should be sought through further experimental and epidemiologic studies.

69 Vecchio et al, 2010, Clin Neurophysiol. 2010 Feb;121(2):163-71.

Mobile phone emission modulates inter-hemispheric functional coupling of EEG alpha rhythms in elderly compared to young subjects.

<http://www.ncbi.nlm.nih.gov/pubmed/20005167>

OBJECTIVE:

It has been reported that GSM electromagnetic fields (GSM-EMFs) of mobile phones modulate--after a prolonged exposure--inter-hemispheric synchronization of temporal and frontal resting electroencephalographic (EEG) rhythms in normal young subjects [Vecchio et al., 2007]. Here we tested the hypothesis that this effect can vary on physiological aging as a sign of changes in the functional organization of cortical neural synchronization.

METHODS:

Eyes-closed resting EEG data were recorded in 16 healthy elderly subjects and 5 young subjects in the two conditions of the previous reference study. The GSM device was turned on (45 min) in one condition and was turned off (45 min) in the other condition. Spectral coherence evaluated the inter-hemispheric synchronization of EEG rhythms at the following bands: delta (about 2-4 Hz), theta (about 4-6 Hz), alpha 1 (about 6-8 Hz), alpha 2 (about 8-10 Hz), and alpha 3 (about 10-12 Hz). The aging effects were investigated comparing the inter-hemispheric EEG coherence in the elderly subjects vs. a young group formed by 15 young subjects (10 young subjects of the reference study; Vecchio et al., 2007).

RESULTS:

Compared with the young subjects, the elderly subjects showed a statistically significant ($p < 0.001$) increment of the inter-hemispheric coherence of frontal and temporal alpha rhythms (about 8-12 Hz) during the GSM condition.

CONCLUSIONS:

These results suggest that GSM-EMFs of a mobile phone affect inter-hemispheric synchronization of the dominant (alpha) EEG rhythms as a function of the physiological aging.

SIGNIFICANCE:

This study provides further evidence that physiological aging is related to changes in the functional organization of cortical neural synchronization.

[Exposure: mobile phone 902.4 MHz (pulsed); continuous for 45 min; SAR 0.5 W/kg max value (brain)]

EHS GENERAL POPULATION SIGNS & SYMPTOMS – RADIO/TV BROADCASTING TRANSMITTER EFFECTS:

70 Abelin et al, 2005, Somnologie (Somnology) 2005; 9 (4): 203 - 209

Sleep Disturbances in the Vicinity of the Short-Wave Broadcast Transmitter Schwarzenburg.

<http://www.emf-portal.de/viewer.php?aid=13159&l=e>

Results/conclusion (according to author)

The prevalence of difficulties of falling asleep and maintaining sleep increased with increasing radiofrequency electromagnetic field exposure in both cross-sectional studies. **Sleep quality improved after transmitter shut-down.** No chronic change of melatonin excretion was observed.

The authors concluded that the results of the studies give strong evidence of a causal relationship between the operation of a short-wave broadcast transmitter and sleep disturbances in the surrounding population, but there is insufficient evidence to distinguish between a biological and psychological effect.

71 Altpeter et al, 2006, Bioelectromagnetics. 2006 Feb;27(2):142-50.

Effect of short-wave (6-22 MHz) magnetic fields on sleep quality and melatonin cycle in humans: the Schwarzenburg shut-down study.

<http://www.ncbi.nlm.nih.gov/pubmed/16342198>

This paper describes the results of a unique "natural experiment" of the operation and cessation of a broadcast transmitter with its short-wave electromagnetic fields (6-22 MHz) on sleep quality and melatonin cycle in a general human population sample. In 1998, 54 volunteers (21 men, 33 women) were followed for 1 week each before and after shut-down of the short-wave radio transmitter at Schwarzenburg (Switzerland). Salivary melatonin was sampled five times a day and total daily excretion and acrophase were estimated using complex cosinor analysis. Sleep quality was recorded daily using a visual analogue scale. **Before shut down, self-rated sleep quality was reduced by 3.9 units (95% CI: 1.7-6.0) per mA/m increase in magnetic field exposure. The corresponding decrease in melatonin excretion was 10% (95% CI: -32 to 20%). After shutdown, sleep quality improved by 1.7 units (95% CI: 0.1-3.4) per mA/m decrease in magnetic field exposure. Melatonin excretion increased by 15% (95% CI: -3 to 36%) compared to baseline values suggesting a rebound effect.** Stratified analyses showed an exposure effect on melatonin excretion in poor sleepers (26% increase; 95% CI: 8-47%) but not in good sleepers. **Change in sleep quality and melatonin excretion was related to the extent of magnetic field reduction after the transmitter's shut down in poor but not good sleepers.** However, blinding of exposure was not possible in this observational study and this may have affected the outcome measurements in a direct or indirect (psychological) way.

[Exposure: 6.1-21.8 MHz amplitude modulation; continuous, studied for 4 days before shut-down; 0.4 and 2.6 mA/m mean value]

72 Kolodynski et al, 1996, Sci Total Environ. 1996 Feb 2;180(1):87-93.

Motor and psychological functions of school children living in the area of the Skrunda Radio Location Station in Latvia.

<http://www.ncbi.nlm.nih.gov/pubmed/8717320>

This paper presents the results of experiments on school children living in the area of the Skrunda Radio Location Station (RLS) in Latvia. **Motor function, memory and attention significantly differed between the exposed and control groups. Children living in front of the RLS had less developed memory and attention, their reaction time was slower and their neuromuscular apparatus endurance was decreased.**

73 Nieto-Hernandez et al, 2011, Occup Environ Med. 2011 May;68(5):339-44

Can exposure to a terrestrial trunked radio (TETRA)-like signal cause symptoms? A randomised double-blind provocation study.

<http://www.ncbi.nlm.nih.gov/pubmed/20864469>

OBJECTIVES:

Concerns have been raised about possible health effects from radiofrequency fields pulsing at around 16 Hz. A radio system used by UK police (TETRA) employs signals which pulse at 17.6 Hz. We tested whether exposure to a continuous wave signal at 385.25 MHz or a TETRA-like signal resulted in symptoms among users reporting sensitivity to TETRA compared to users not reporting sensitivity to TETRA.

METHODS:

60 sensitive and 60 non-sensitive users were exposed to three 50 min conditions: a signal with a 16 Hz component, a continuous wave condition and a sham condition. The mean radiated power for the 16 Hz and continuous wave conditions was 250 mW. The order of conditions was randomised and testing was conducted double-blind. Participants reported the severity of eight symptoms during and after each exposure, their mood state at the end of each exposure, and whether they could tell which sessions involved active signals. The study was registered in advance with the ISRCTN register.

RESULTS:

Exposure to the continuous wave signal increased ratings of headache in all participants, fatigue in non-sensitive participants and difficulty concentrating in sensitive participants. Paradoxically, it reduced sensations of itching in sensitive participants. These effects were not observed in the condition with 16 Hz pulsing, except for those relating to concentration. Adjusting for multiple comparisons removed most significant effects, but not those relating to itch.

CONCLUSIONS:

The results suggested that exposure to TETRA signals is not responsible for symptoms reported by some users, although exposure to a continuous wave signal may affect symptoms. Clinical trial number ISRCTN 73321766.

[Exposure: 385.25 MHz; continuous for 50 min; SAR 1.3 W/kg max valu (10g) (close to antenna), 0.3 W/kg average over mass (10g) (from the handset)]

74 Vangelova K et al, 2006, Int J Hyg Environ Health. 209(2):133-138, 2006

Cardiovascular risk in operators under radiofrequency electromagnetic radiation.

<http://www.ncbi.nlm.nih.gov/pubmed/16503299>

The aim of the study was to assess the long-term effects of radiofrequency electromagnetic radiation (EMR) on the cardiovascular system. Two groups of exposed operators (49 broadcasting (BC) station and 61 TV station operators) and a control group of 110 radiorelay station operators, matched by sex and age, with similar job characteristics except for the radiofrequency EMR were studied. The EMR exposure was assessed and the time-weighted average (TWA) was calculated. The cardiovascular risk factors arterial pressure, lipid profile, body mass index, waist/hip ratio, smoking, and family history of cardiovascular disease were followed. **The systolic and diastolic blood pressure (SBP and DBP), total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) were significantly higher in the two exposed groups. It was found that the radiofrequency EMR exposure was associated with greater chance of becoming hypertensive and dyslipidemic. The stepwise multiple regression equations showed that the SBP and TWA predicted the high TC and high LDL-C, while the TC, age and abdominal obesity were predictors for high SBP and DBP. In conclusion, our data show that the radiofrequency EMR contributes to adverse effects on the cardiovascular system.**

[Exposure: 6-25 MHz (broadcasting station) and 66-900 MHz (TV station); 20.7 ± 5.5 years and 18.6 ± 8.9 years (average length of service) respectively]

EHS GENERAL POPULATION SIGNS & SYMPTOMS – SMART METER EFFECTS:

75 Quebec Huffington Post, October 2013

A first clinical study documents the harmful effects of smart meters

http://quebec.huffingtonpost.ca/2013/11/25/etude-clinique-sur-les-effets-nocifs-des-compteurs-intelligents_n_4309494.html?utm_hp_ref=canada-quebec&just_reloaded=1

[Author's note: translated using Google Translate].

An Australian family physician has carefully documented 92 cases of patients with symptoms of EHS occurred after the installation of an electricity meter emits radio frequency (RF) pulse.

World first, the case study of Dr. Federica Lamech has not been published by a scientific journal peer-reviewed. According to the American Academy of Environmental Medicine (AAEM), it is nonetheless "scientifically valid" and "clearly shows the harmful effects of smart meters emissions on the health of the human population." International Association founded in 1965, the AAEM includes doctors and other health professionals who are interested in the impact of the environment on health.

The symptoms observed in patients of Dr. Lamech such as fatigue, headaches, heart palpitations or dizziness are correlated with the guidelines of the Austrian Medical Association for the diagnosis and treatment of the fields related health problems electromagnetic (EMC), emphasizes the AAEM. They also could be triggered in the laboratory by EMF exposure under controlled conditions (double-blind, placebo-exposure): neither the patients nor the researchers knew who was exposed or not to EMF.

"The scientific peer-reviewed literature demonstrating the correlation between exposure to EMF / RF and neurological, cardiac and pulmonary diseases and reproductive disorders, immune dysfunction, cancer and other health problems, adds the EMEA. The evidence is irrefutable. "

The organization insists that it is "extremely important" to note that the vast majority of 92 Australian patients were not electrohypersensitive before installing the new generation meter. Dr. Lamech concludes that smart meters "may have unique characteristics that lower development threshold symptoms of people."...

....Often called smart meters, new generation meters transmit utilities information about amounts of electricity, gas or water consumed in buildings. Transmission of this information is wireless, using microwave type of radio frequency (typically at frequencies 900 MHz and 2.4 GHz).

EHS GENERAL POPULATION SIGNS & SYMPTOMS– MRI SCANNERS:

76 Friebe et al, 2014, J Magn Reson Imaging. 2014 Sep 19.

Sensory perceptions of individuals exposed to the static field of a 7T MRI: A controlled blinded study.

<http://www.ncbi.nlm.nih.gov/pubmed/25236353>

PURPOSE:

To determine the subjective experience of subjects undergoing 7T magnetic resonance imaging (MRI) compared to a mock scanner with no magnetic field.

METHODS AND MATERIALS:

In all, 44 healthy subjects were exposed to both the B0 field of a 7T whole-body MRI and a realistic mock scanner with no magnetic field. Subjects were blinded to the actual field strength and no scanning was performed. After exposure, subjects rated their experience of potential sensory perceptions.

RESULTS:

The most frequently observed side effect was vertigo while entering the gantry, which was reported by 38.6% (n = 17). Other frequent side effects were the appearance of phosphenes (18.2%, n = 8), thermal heat sensation (15.9%), unsteady gait after exposure (13.6%, n = 6), and dizziness (13.6%). All side effects were reported significantly more often after 7T exposure. Nine subjects (20.5%) did not report any sensory perceptions at all, ie, neither in the 7T scanner nor in the mock scanner.

CONCLUSION:

Light, acute, and transient sensory perceptions can occur in subjects undergoing ultrahighfield MRI, of which vertigo seems to be the most frequently reported. Possible psychological effects might contribute to the emergence of such sensory perceptions, as some subjects also reported them to appear in a realistic mock scanner with no magnetic field.

77 Heilmaier et al, 2011, Bioelectromagnetics. 2011 Dec;32(8):610-9

A large-scale study on subjective perception of discomfort during 7 and 1.5T MRI examinations.

<http://www.ncbi.nlm.nih.gov/pubmed/21598286>

A study on subjective perception has been carried out in order to gain further insight into subjective discomfort and sensations experienced during 7T magnetic resonance imaging (MRI). This study provides information about subjective acceptance, which is essential if 7T MRI is to become a clinical diagnostic tool. Of 573 subjects who underwent T MRI, 166 were also examined at 1.5T, providing a means of discriminating field-dependent discomfort. All subjects judged sources of discomfort and physiological sensations on an 11-point scale (0=no side effects, 10=intolerable side effects) and scores were analyzed separately for exam phases, with and without table movement at each field strength. **Results revealed that 7T MRI was, in general, judged more uncomfortable than 1.5T;** however, most subjects rated the effects as being non-critical (mean scores between 0.5 and 3.5). **Significant differences were detected regarding vertigo and sweating between subjects positioned "head-first" and "feet-first" at 7T (worse in "head-first") and between 7 and 1.5T (worse at 7T), with the effects being more pronounced in the moving compared to the stationary table position. The most unpleasant factor at 7T was the extensive examination duration, while potentially field-dependent sensations were rated less bothersome.** In summary, our study indicates that although certain sensations increase at 7T compared to 1.5T, they are unlikely to hinder the use of 7T MRI as a clinical diagnostic tool.

78 Heinrich et al, 2013, Radiology. 2013 Jan;266(1):236-45.

Cognition and sensation in very high static magnetic fields: a randomized case-crossover study with different field strengths.

<http://www.ncbi.nlm.nih.gov/pubmed/23091174>

PURPOSE:

To establish the extent to which representative cognitive functions in subjects undergoing magnetic resonance (MR) imaging are acutely impaired by static magnetic fields of varying field strengths.

MATERIALS AND METHODS:

This study was approved by the local ethics committee, and informed consent was obtained from all subjects. In this single-blind case-crossover study, 41 healthy subjects underwent an extensive neuropsychologic examination while in MR units of differing field strengths (1.5, 3.0, and 7.0 T), including a mock imager with no magnetic field as a control condition. Subjects were blinded to field strength. Tests were performed while subjects were lying still in the MR unit and while the examination table was moved. The tests covered a representative set of cognitive functions, such as memory, eye-hand coordination, attention, reaction time, and visual discrimination. Subjective sensory perceptions were also assessed. Effects were analyzed with a repeated-measures analysis of variance; the within-subject factors were field strength (0, 1.5, 3.0, and 7.0 T) and state (static, dynamic).

RESULTS:

Static magnetic fields were not found to have a significant effect on cognitive function at any field strength. **However, sensory perceptions did vary according to field strength. Dizziness, nystagmus, phosphenes, and head ringing were related to the strength of the static magnetic field.**

CONCLUSION:

Static magnetic fields as high as 7.0 T did not have a significant effect on cognition.

79 Heinrich et al, 2011, J Magn Reson Imaging. 2011 Oct;34(4):758-63.

Effects of static magnetic fields on cognition, vital signs, and sensory perception: a meta-analysis.

<http://www.ncbi.nlm.nih.gov/pubmed/21751291>

To evaluate whether cognitive processes, sensory perception, and vital signs might be influenced by static magnetic fields in magnetic resonance imaging (MRI), which could pose a risk for health personnel and patients, we conducted a meta-analysis of studies that examined effects of static magnetic fields. Studies covering the time from 1992 to 2007 were selected. Cohen's d effects sizes were used and combined in different categories of neuropsychology (reaction time, visual processing, eye-hand coordination, and working memory). Additionally, effects of static magnetic fields on sensory perception and vital signs were analyzed. In the category "neuropsychology," only **effects on the visual system were homogeneous, showing a statistically significant impairment as a result of exposure to static magnetic fields (d = -0.415).** Vital signs were not affected and **effects on sensory perceptions included an increase of dizziness and vertigo, primarily caused by movement during static magnetic field gradient exposures.** The number of studies dealing with this topic is very small and the experimental set-up of some of the analyzed studies makes it difficult to accurately determine the effects of static magnetic fields by themselves, excluding nonspecific factors. The implications of these results for MRI lead to suggestions for improvement in research designs.

80 Mian et al, 2013, PLoS One. 2013 Oct 30;8(10):e78748.

On the vertigo due to static magnetic fields.

<http://www.ncbi.nlm.nih.gov/pubmed/24205304>

Vertigo is sometimes experienced in and around MRI scanners. Mechanisms involving stimulation of the vestibular system by movement in magnetic fields or magnetic field spatial gradients have been proposed. However, it was recently shown that vestibular-dependent ocular nystagmus is evoked when stationary in homogenous static magnetic fields. **The proposed mechanism involves Lorentz forces acting on endolymph to deflect semicircular canal (SCC) cupulae.** To investigate whether vertigo arises from a similar mechanism we recorded qualitative and quantitative aspects of vertigo and 2D eye movements from supine healthy adults (n=25) deprived of vision while pushed into the 7T static field of an MRI scanner. Exposures were variable and included up to 135s stationary at 7T. Nystagmus was mainly horizontal, persisted during long-exposures with partial decline, and reversed upon withdrawal. The dominant vertiginous perception with the head facing up was rotation in the horizontal plane (85% incidence) with a consistent direction across participants. With the head turned 90 degrees in yaw the perception did not transform into equivalent vertical plane rotation, indicating a context-dependency of the perception. During long exposures, illusory rotation lasted on average 50 s, including 42 s whilst stationary at 7T. Upon withdrawal, perception re-emerged and reversed, lasting on average 30 s. Onset fields for nystagmus and perception were significantly correlated (p<.05). Although perception did not persist as long as nystagmus, this is a known feature of continuous SSC stimulation. **These observations, and others in the paper, are compatible with magnetic-field evoked-vertigo and nystagmus sharing a common mechanism. With this interpretation, response decay and reversal upon withdrawal from the field, are due to adaptation to continuous vestibular input. Although the study does not entirely exclude the possibility of mechanisms involving transient vestibular stimulation during movement in and out of the bore, we argue these are less likely.**

81 Patel et al, 2008, J Occup Environ Med. 2008 May;50(5):576-83.

Pilot study investigating the effect of the static magnetic field from a 9.4-T MRI on the vestibular system.

<http://www.ncbi.nlm.nih.gov/pubmed/18469627>

OBJECTIVE:

To objectively evaluate workers' sensory symptoms and vestibular function after exposure to a strong, new generation 9.4-T Magnetic Resonance Imaging (MRI) scanner.

METHOD:

Six MRI employees underwent standardized electronystagmographic evaluation, postural testing, and caloric function at baseline evaluation, 30 minutes postexposure to 9.4 T static field and at a 3-month follow-up.

RESULTS:

All participants noted sensory symptoms after exposure. No overall deterioration in vestibular function was noted following 30-minute exposure or at a 3-month follow-up. **A higher occurrence of tonic vestibular asymmetry, hyperreactive caloric responses, and spontaneous nystagmus was noted compared with that of the normal population.**

CONCLUSION:

Workers exposed to the new, stronger MRIs experience sensory symptoms but it is unclear as yet whether long-term vestibular damage occurs. The higher rates of vestibular changes noted could argue for improved worker surveillance and exposure control.

82 Schlammann et al, 2010, Acad Radiol. 2010 Mar;17(3):277-81.

Short term effects of magnetic resonance imaging on excitability of the motor cortex at 1.5T and 7T.

<http://www.ncbi.nlm.nih.gov/pubmed/20036585>

RATIONALE AND OBJECTIVES:

The increasing spread of high-field and ultra-high-field magnetic resonance imaging (MRI) scanners has encouraged new discussion of the safety aspects of MRI. Few studies have been published on possible cognitive effects of MRI examinations. The aim of this study was to examine whether changes are measurable after MRI examinations at 1.5 and 7 T by means of transcranial magnetic stimulation (TMS).

MATERIALS AND METHODS:

TMS was performed in 12 healthy, right-handed male volunteers. First the individual motor threshold was specified, and then the cortical silent period (SP) was measured. Subsequently, the volunteers were exposed to the 1.5-T MRI scanner for 63 minutes using standard sequences. The MRI examination was immediately followed by another TMS session. Fifteen minutes later, TMS was repeated. Four weeks later, the complete setting was repeated using a 7-T scanner. Control conditions included lying in the 1.5-T scanner for 63 minutes without scanning and lying in a separate room for 63 minutes. TMS was performed in the same way in each case. For statistical analysis, Wilcoxon's rank test was performed.

RESULTS:

Immediately after MRI exposure, the SP was highly significantly prolonged in all 12 subjects at 1.5 and 7 T. The motor threshold was significantly increased. Fifteen minutes after the examination, the measured value tended toward normal again. Control conditions revealed no significant differences.

CONCLUSION:

MRI examinations lead to a transient and highly significant alteration in cortical excitability. This effect does not seem to depend on the strength of the static magnetic field.

83 Schlammann et al, 2009, Rofo. 2009 Mar;181(3):215-9.

Effects of MRI on the electrophysiology of the motor cortex: a TMS study [Article in German]

<http://www.ncbi.nlm.nih.gov/pubmed/19229786>

PURPOSE:

The increasing spread of high-field and ultra-high-field MRI scanners encouraged a new discussion on safety aspects of MRI examinations. Earlier studies report altered acoustically evoked potentials. This finding was not able to be confirmed in later studies. In the present study transcranial magnetic stimulation (TMS) was used to evaluate whether motor cortical excitability may be altered following MRI examination even at field strength of 1.5 T.

MATERIALS AND METHODS:

In 12 right-handed male volunteers individual thresholds for motor responses and then the length of the post-excitatory inhibition (silent period) were determined. Subsequently the volunteers were examined in the MRI scanner (Siemens Avanto, 1.5 T) for 63 minutes using gradient and spin echo sequences. MRI examination was immediately followed by another TMS session and a third 10 minutes later. As a control condition, the 12 subjects spent one hour in the scanner without examination and one hour on a couch without the presence of a scanner.

RESULTS:

After MRI examination, the silent period was significantly lengthened in all 12 subjects and then tended to the initial value after 10 min. Motor thresholds were significantly elevated and then normalized after 10 minutes. No significant effects were found in the control conditions.

CONCLUSION:

MRI examination leads to a transient effect on motor cortical excitability indicated by elongation of the post-excitatory inhibition and to an increase in motor thresholds in some subjects. These effects do not seem to be associated with a static magnetic field.

84 Straumann & Bockisch, 2011, Curr Biol. 2011 Oct 11;21(19):R806-7.

Neurophysiology: vertigo in MRI machines.

<http://www.ncbi.nlm.nih.gov/pubmed/21996500>

Subjects of brain-imaging studies often report experiencing vertigo while in MRI machines; a new study shows that the magnetic field stimulates the vestibular sensors in the inner ear by a Lorentz force.

85 van Nierop et al, 2013, Magn Reson Med. 2013 Jul;70(1):232-40.

MRI-related static magnetic stray fields and postural body sway: a double-blind randomized crossover study.

<http://www.ncbi.nlm.nih.gov/pubmed/22886724>

We assessed postural body sway performance after exposure to movement induced time-varying magnetic fields in the static magnetic stray field in front of a 7 Tesla (T) magnetic resonance imaging scanner. Using a double blind randomized crossover design, 30 healthy volunteers performed two balance tasks (i.e., standing with eyes closed and feet in parallel and then in tandem position) after standardized head movements in a sham, low exposure (on average 0.24 T static magnetic stray field and 0.49 T-s(-1) time-varying magnetic field) and high exposure condition (0.37 T and 0.70 T-s(-1)). Personal exposure to static magnetic stray fields and time-varying magnetic fields was measured with a personal dosimeter. Postural body sway was expressed in sway path, area, and velocity. **Mixed-effects model regression analysis showed that postural body sway in the parallel task was negatively affected ($P < 0.05$) by exposure on all three measures. The tandem task revealed the same trend, but did not reach statistical significance.** Further studies are needed to investigate the possibility of independent or synergetic effects of static magnetic stray field and time-varying magnetic field exposure. In addition, **practical safety implications of these findings, e.g., for surgeons and others working near magnetic resonance imaging scanners need to be investigated.**

86 van Nierop et al, 2012, Occup Environ Med. 2012 Oct;69(10):759-66.

Effects of magnetic stray fields from a 7 tesla MRI scanner on neurocognition: a double-blind randomised crossover study.

<http://www.ncbi.nlm.nih.gov/pubmed/22930737>

OBJECTIVE:

This study characterises neurocognitive domains that are affected by movement-induced time-varying magnetic fields (TVMF) within a static magnetic stray field (SMF) of a 7 Tesla (T) MRI scanner.

METHODS:

Using a double-blind randomised crossover design, 31 healthy volunteers were tested in a sham (0 T), low (0.5 T) and high (1.0 T) SMF exposure condition. Standardised head movements were made before every neurocognitive task to induce TVMF.

RESULTS:

Of the six tested neurocognitive domains, **we demonstrated that attention and concentration were negatively affected when exposed to TVMF within an SMF (varying from 5.0% to 21.1% per Tesla exposure, $p < 0.05$), particular in situations where high working memory performance was required. In addition, visuospatial orientation was affected after exposure (46.7% per Tesla exposure, $p = 0.05$).**

CONCLUSION:

Neurocognitive functioning is modulated when exposed to movement-induced TVMF within an SMF of a 7 T MRI scanner. Domains that were affected include attention/concentration and visuospatial orientation. Further studies are needed to better understand the mechanisms and possible practical safety and health implications of these acute neurocognitive effects.

EHS GENERAL POPULATION SIGNS & SYMPTOMS – OTHER RF SOURCES:

87 Lustenberger et al, 2013, Brain Stimul. 2013 Sep;6(5):805-11

Stimulation of the brain with radiofrequency electromagnetic field pulses affects sleep-dependent performance improvement.

<http://www.ncbi.nlm.nih.gov/pubmed/23482083>

http://www.emf-portal.de/viewer.php?aid=21895&sid=6548580b3eb1e6c4cb4444b33ea2ca2b&sform=8&pag_idx=0&l=e

Abstract:

BACKGROUND:

Sleep-dependent performance improvements seem to be closely related to sleep spindles (12-15 Hz) and sleep slow-wave activity (SWA, 0.75-4.5 Hz). Pulse-modulated radiofrequency electromagnetic fields (RF EMF, carrier frequency 900 MHz) are capable to modulate these electroencephalographic (EEG) characteristics of sleep.

OBJECTIVE:

The aim of our study was to explore possible mechanisms how RF EMF affect cortical activity during sleep and to test whether such effects on cortical activity during sleep interact with sleep-dependent performance changes.

METHODS:

Sixteen male subjects underwent 2 experimental nights, one of them with all-night 0.25-0.8 Hz pulsed RF EMF exposure. All-night EEG was recorded. To investigate RF EMF induced changes in overnight performance improvement, subjects were trained for both nights on a motor task in the evening and the morning.

RESULTS:

We obtained good sleep quality in all subjects under both conditions (mean sleep efficiency > 90%). After pulsed RF EMF **we found increased SWA during exposure to pulse-modulated RF EMF** compared to sham exposure ($P < 0.05$) toward the end of the sleep period. Spindle activity was not affected. Moreover, subjects showed an increased RF EMF burst-related response in the SWA range, indicated by an increase in event-related EEG spectral power and phase changes in the SWA range. **Notably, during exposure, sleep-dependent performance improvement in the motor sequence task was reduced compared to the sham condition** (-20.1% , $P = 0.03$).

CONCLUSION:

The changes in the time course of SWA during the exposure night may **reflect an interaction of RF EMF with the renormalization of cortical excitability during sleep, with a negative impact on sleep-dependent performance improvement.**

[Exposure: 900 MHz pulsed; intermittent during 8h (during the sleep, exposure of 5 min 'intermittent 1' was followed by 1 min with no exposure (OFF phase), then 5 min 'intermittent 2' was followed by a 7 min OFF phase; this 18 min sequence was repeated throughout the whole night; SAR 0.15 W/kg spatial average (10g) peak spatial SAR during the whole night, 10 W/kg spatial average (10g) peak spatial SAR during the 7.1 ms pulses, 1 W/kg (500 ms burst average), 0.125 W/kg ('intermittent 1' average), 0.4 W/kg ('intermittent 2' average)]

88 Perentos et al, 2013, IEEE Trans Biomed Eng. 2013 Jun;60(6):1702-10.

The alpha band of the resting electroencephalogram under pulsed and continuous radio frequency exposures.

<http://www.ncbi.nlm.nih.gov/pubmed/23358937>

The effect of GSM-like electromagnetic fields with the resting electroencephalogram (EEG) alpha band activity was investigated in a double-blind cross-over experimental paradigm, testing the hypothesis that pulsed but not continuous radio frequency (RF) exposure would affect alpha activity, and the hypothesis that GSM-like pulsed low frequency fields would affect alpha. Seventy-two healthy volunteers attended a single recording session where the eyes open resting EEG activity was recorded. Four exposure intervals were presented (sham, pulsed modulated RF, continuous RF, and pulsed low frequency) in a counterbalanced order where each exposure lasted for 20 min. Compared to sham, a suppression of the global alpha band activity was observed under the pulsed modulated RF exposure, and this did not differ from the continuous RF exposure. No effect was seen in the extremely low frequency condition. That there was an effect of pulsed RF that did not differ significantly from continuous RF exposure does not support the hypothesis that "pulsed" RF is required to produce EEG effects. **The results support the view that alpha is altered by RF electromagnetic fields**, but suggest that the pulsing nature of the fields is not essential for this effect to occur.

[Exposure: specially designed handset, unspecified frequency (condition 1 continuous wave, condition 2 pulsed); continuous for 3 x 20 min; condition 1. SAR 1.95 W/kg spatial average (10g), condition 2. SAR 0.06 W/kg, 1.95 W/kg peak value]

PROVEN PHYSIOLOGICAL CONDITION:

89 Johansson O, "Elöverkänslighet samt överkänslighet mot mobiltelefoner: Resultat från en dubbel-blind provokationsstudie av metodstudiekaraktär" ("Electrohyper-sensitivity and sensitivity to mobile telephones: Results from a double-blind provocation study of pilot character", in Swedish), Enheten för Experimentell Dermatologi, Karolinska Institutet, Stockholm, Rapport nr. 2, 1995, ISSN 1400-6111

90 McCarty et al, Int J Neurosci. 2011 Dec;121(12):670-6.

Electromagnetic hypersensitivity: evidence for a novel neurological syndrome.

<http://www.ncbi.nlm.nih.gov/pubmed/21793784>

<http://andrewamarino.com/PDFs/171-IntJNeurosci2011.pdf> (full paper)

Objective: We sought direct evidence that acute exposure to environmental-strength electromagnetic fields (EMFs) could induce somatic reactions (EMF hypersensitivity). Methods: The subject, a female physician selfdiagnosed with EMF hypersensitivity, was exposed to an average (over the head) 60-Hz electric field of 300 V/m (comparable with typical environmental-strength EMFs) during controlled provocation and behavioral studies. Results: In a double-blinded EMF provocation procedure specifically designed to minimize unintentional sensory cues, **the subject developed temporal pain, headache, muscle twitching, and skipped heartbeats within 1 00 s after initiation of EMF exposure ($p < .05$). The symptoms were caused primarily by field transitions (off-on, on-off) rather than the presence**

of the field, as assessed by comparing the frequency and severity of the effects of pulsed and continuous fields in relation to sham exposure. The subject had no conscious perception of the field as judged by her inability to report its presence more often than in the sham control. **Discussion: The subject demonstrated statistically reliable somatic reactions in response to exposure to subliminal EMFs under conditions that reasonably excluded a causative role for psychological processes. Conclusion: EMF hypersensitivity can occur as a bona fide environmentally inducible neurological syndrome.**

TABLE 3.

Evaluation of the relation between presentation of a pulsed electric field and the development of symptoms.

(b) Summary table

Field condition	Symptoms		
	None	Mild	>=Mild
Sham	5	5	0
Pulsed field *	0	0	10

*p <.05

TABLE 4.

Evaluation of the comparative effect of continuous and pulsed fields relative to a sham field on the development of symptoms. (b) Summary table

Field condition	Symptoms		
	None	Mild	>=Mild
Sham	4	1	0
Continuous	2	0	3
Pulsed field *	0	2	3

*p <.05

Discussion

.... The subject developed symptoms in association with the presentation of a pulsed electric field significantly ($p < .05$) more often than could reasonably be explained on the basis of chance (see Table 3). Several considerations suggested that the statistical link was a true causal association with a subliminal EMF. First, the subject's environment was carefully controlled to avoid putative confounding factors. The testing took place in an acoustically quiet environment, and the presence of uncontrolled environmental EMFs was nil. The environmental conditions during the field-exposure and sham-exposure intervals were identical except that during the sham-exposure intervals, at a point far removed from the subject's field of view, the wires carrying the plate voltage were disconnected. A key aspect of our laboratory procedure was the elimination of sensory cues that could serve as conscious markers of the electric field leading to a somatization reaction. All appropriate precautions were taken to eliminate potential confounders. Second, the occurrence of symptoms was significantly associated with the type of EMF (see Table 4). The symptomatic response was associated with the pulsed EMF, which maximized occurrence of the number of transient changes in the EMF (off - on and on-off), not with the presence of the field, as expected on the basis of prior animal studies where the issue of somatization was irrelevant (Frilot et al., 2011).....

PROVOCATION STUDIES:

See also: Griesz-Brisson 2013¹⁰¹, Heilmaier 2011⁷⁶, Nieto-Hernandez 2011⁷³.

91 Havas, 2013, Rev Environ Health. 2013;28(2-3):75-84.

Radiation from wireless technology affects the blood, the heart, and the autonomic nervous system.

<http://www.ncbi.nlm.nih.gov/pubmed/24192494>

Exposure to electrosmog generated by electric, electronic, and wireless technology is accelerating to the point that a portion of the population is experiencing adverse reactions when they are exposed. The symptoms of electrohypersensitivity (EHS), best described as rapid aging syndrome, experienced by adults and children resemble symptoms experienced by radar operators in the 1940s to the 1960s and are well described in the literature. An increasingly common response includes clumping (rouleau formation) of the red blood cells, heart palpitations, pain or pressure in the chest accompanied by anxiety, and an upregulation of the sympathetic nervous system coincident with a downregulation of the parasympathetic nervous system typical of the "fight-or-flight" response. **Provocation studies presented in this article demonstrate that the response to electrosmog is physiologic and not psychosomatic.** Those who experience prolonged and severe EHS may develop psychologic problems as a consequence of their inability to work, their limited ability to travel in our highly technologic environment, and the social stigma that their symptoms are imagined rather than real.

92 Leitgeb & Schröttner, 2003, Bioelectromagnetics. 2003 Sep;24(6):387-94.

Electrosensitivity and electromagnetic hypersensitivity.

<http://www.ncbi.nlm.nih.gov/pubmed/12929157/>

Electromagnetic sensibility, the ability to perceive electric and electromagnetic exposure, and electromagnetic hypersensitivity (EHS), developing health symptoms due to exposure to environmental electromagnetic fields, need to be distinguished. Increased electrosensitivity is a necessary, however, not a sufficient condition for electromagnetic hypersensitivity. At an extended sample of the general population of 708 adults, including 349 men and 359 women aged between 17 and 60 years, electrosensitivity was investigated and characterized by perception threshold and its standard deviation. By analyzing the probability distributions of the perception threshold of electric 50 Hz currents, **evidence could be found for the existence of a subgroup of people with significantly increased electrosensitivity (hypersensitivity) who as a group could be differentiated from the general population. The presented data show that the variation of the electrosensitivity among the general population is significantly larger than has yet been estimated by nonionizing radiation protection bodies**, but much smaller than claimed by hypersensitivity self-aid groups. These quantitative results should contribute to a less emotional discussion of this problem. The investigation method presented, is capable of exclusion diagnostics for persons suffering from the hypersensitivity syndrome. **[Author's note: this investigation method alone is not capable of exclusion diagnostics as EHS symptoms are likely produced via several mechanistic pathways not one.]**

93 Rea et al. (1991), Journal of Bioelectricity, 10(1&2), 241-256.

Electromagnetic Field Sensitivity.

<http://informahealthcare.com/doi/abs/10.3109/15368379109031410>

A multiphase study was performed to find an effective method to evaluate electromagnetic field (EMF) sensitivity of patients. The first phase developed criteria for controlled testing using an environment low in chemical, particulate, and EMF pollution. Monitoring devices were used in an effort to ensure that extraneous EMF would not interfere with the tests. A second phase involved a single-blind challenge of 100 patients who complained of EMF sensitivity to a series of fields ranging from 0 to 5 MHz in frequency, plus 5 blank challenges. **Twenty-five patients were found who were sensitive to the fields, but did not react to the blanks.** These were compared in the third phase to 25 healthy naive volunteer controls. None of the volunteers reacted to any challenge, active or blank, but **16 of the EMF-sensitive patients (64%) had positive signs and symptoms scores, plus autonomic nervous system changes. In the fourth phase, the 16 EMF-sensitive patients were rechallenged twice to the frequencies to which they were most sensitive during the previous challenge. The active frequency was found to be positive in 100% of the challenges, while all of the placebo tests were negative. we concluded that this study gives strong evidence that electromagnetic field sensitivity exists, and can be elicited under environmentally controlled conditions.**

94 Sandström et al, 1997, J Occup Environ Med. 1997 Jan;39(1):15-22.

Neurophysiological effects of flickering light in patients with perceived electrical hypersensitivity.

<http://www.ncbi.nlm.nih.gov/pubmed/9029427>

An increasing number of people in Sweden are claiming that they are hypersensitive to electricity. These patients suffer from skin as well as neurological symptoms when they are near computer monitors, fluorescent tubes, or other electrical appliances. Provocation studies with electromagnetic fields emitted from these appliances have, with only one exception, all been negative, indicating that there are other factors in the office environment that can effect the autonomic and/or central nervous system, resulting in the symptoms reported. Flickering light is one such factor and was therefore chosen as the exposure parameter in this study. Ten patients complaining of electrical hypersensitivity and the same number of healthy voluntary control subjects were exposed to amplitude-modulated light. The sensitivity of the brain to this type of visual stimulation was tested by means of objective electrophysiological methods such as electroretinography and visual evoked potential. **A higher amplitude of brain cortical responses at all frequencies of stimulation was found when comparing patients with the control subjects**, whereas no differences in retinal responses were revealed.

95 Tuengler & von Klitzing, 2013, Electromagn Biol Med. 2013 Sep;32(3):281-90.

Hypothesis on how to measure electromagnetic hypersensitivity.

<http://www.ncbi.nlm.nih.gov/pubmed/23301924>

Electromagnetic hypersensitivity (EHS) is an ill-defined term to describe the fact that people who experience health symptoms in the vicinity of electromagnetic fields (EMFs) regard them as causal for their complaints. Up to now most scientists assume a psychological cause for the suffering of electromagnetic hypersensitive individuals. This paper addresses reasons why most provocation studies could not find any association between EMF exposure and EHS and

presents a hypothesis on diagnosis and differentiation of this condition. Simultaneous recordings of **heart rate variability, microcirculation and electric skin potentials are used for classification of EHS. Thus, it could be possible to distinguish "genuine" electromagnetic hypersensitive individuals from those who suffer from other conditions.**

PAPERS DEMONSTRATING PHYSIOLOGICAL VARIATIONS IN EHS:

See also: Abdel-Rassoul 2007²⁵, Bortkiewica 2004²⁶, Eger 2010²⁸, Hutter 2006³¹, Khurana 2010³³, Leitgeb & Schröttner 2003⁹², Sandström 1997⁹⁴, Santini 2002³⁷.

96 Interview with Dr Belpomme, President of the Association for Research on Treatment Against Cancer (ARTAC) and Founder of the European Cancer and Environment Research Institute (ECERI), 2014

Electrosensitivity is a Pre-Alzheimer's state

<http://electromagnetichealth.org/electromagnetic-health-blog/electrosensitivity-a-pre-alzheimers-state/>

Dr. Belpomme has questioned and clinically examined more than 1,000 electrohypersensitivity (EHS) self-reported persons. He says, **"These are real sick people who are in a Pre-Alzheimer's state." He says the most conclusive scientific proof of biological effect are animal studies and biological tests in EHS persons which indicate a Pre-Alzheimer's state.**

The lab tests that show the irregularities (also found in animals exposed to EMF), he says, include:

1. **Brain imagery showing vascular hypoperfusion** in the area of the brain (the limbic system) where Alzheimer's starts
2. 2-10 times **higher levels of histamine** in the blood.
3. Detection of other markers of the **opening of the blood brain barrier.**
4. Higher levels of **auto-antibodies against O- myelin and/or stress proteins**
5. **Decrease in the production of melatonin** in 24h urine.

97 Belyaev et al, 2009, Bioelectromagnetics. 2009 Feb;30(2):129-41.

Microwaves from UMTS/GSM mobile phones induce long-lasting inhibition of 53BP1/gamma-H2AX DNA repair foci in human lymphocytes.

<http://www.ncbi.nlm.nih.gov/pubmed/18839414>

We have recently described frequency-dependent effects of mobile phone microwaves (MWs) of global system for mobile communication (GSM) on human lymphocytes from persons reporting hypersensitivity to electromagnetic fields and healthy persons. Contrary to GSM, universal global telecommunications system (UMTS) mobile phones emit wide-band MW signals. Hypothetically, UMTS MWs may result in higher biological effects compared to GSM signal because of eventual "effective" frequencies within the wideband. **Here, we report for the first time that UMTS MWs affect chromatin and inhibit formation of DNA double-strand breaks co-localizing 53BP1/gamma-H2AX DNA repair foci in human lymphocytes from hypersensitive and healthy persons and confirm that effects of GSM MWs depend on carrier frequency. Remarkably, the effects of MWs on 53BP1/gamma-H2AX foci persisted up to 72 h following exposure of cells, even longer than the stress response following heat shock.** The data are in line with the hypothesis that the type of signal, UMTS MWs, may have higher biological efficiency and possibly larger health risk effects compared to GSM radiation emissions. No significant differences in effects between groups of healthy and hypersensitive subjects were observed, except for the **effects of UMTS MWs and GSM-915 MHz MWs on the formation of the DNA repair foci, which were different for hypersensitive ($P < 0.02[53BP1]/[0.01[\text{gamma-H2AX}]]$) but not for control subjects ($P > 0.05$).** The non-parametric statistics used here did not indicate specificity of the differences revealed between the effects of GSM and UMTS MWs on cells from hypersensitive subjects and more data are needed to study the nature of these differences.

98 Dahmen et al, 2009, Bioelectromagnetics. 2009 May;30(4):299-306.

Blood laboratory findings in patients suffering from self-perceived electromagnetic hypersensitivity (EHS).

<http://www.ncbi.nlm.nih.gov/pubmed/19259984>

Risks from electromagnetic devices are of considerable concern. Electrohypersensitive (EHS) persons attribute a variety of rather unspecific symptoms to exposure to electromagnetic fields. The pathophysiology of EHS is unknown and therapy remains a challenge. We hypothesized that some electrosensitive individuals are suffering from common somatic health problems. Toward this end we analysed clinical laboratory parameters including thyroid-stimulating hormone (TSH), alanine transaminase (ALT), aspartate transaminase (AST), creatinine, hemoglobine, hematocrit and c-reactive protein (CRP) in subjects suffering from EHS and in controls that are routinely used in clinical medicine to identify or screen for common somatic disorders. One hundred thirty-two patients (n = 42 males and n = 90 females) and 101 controls (n = 34 males and n = 67 females) were recruited. **Our results identified laboratory signs of thyroid dysfunction, liver dysfunction and chronic inflammatory processes in small but remarkable fractions of EHS sufferers**

as potential sources of symptoms that merit further investigation in future studies. In the cases of TSH and ALT/AST there were significant differences between cases and controls. The hypotheses of anaemia or kidney dysfunction playing a major role in EHS could be unambiguously refuted. Clinically it is recommended to check for signs of treatable somatic conditions when caring for individuals suffering from self-proclaimed EHS.

99 De Luca et al, 2014, Mediators Inflamm. 2014;2014:924184.

Metabolic and genetic screening of electromagnetic hypersensitive subjects as a feasible tool for diagnostics and intervention.

<http://www.ncbi.nlm.nih.gov/pubmed/24812443>

Growing numbers of "electromagnetic hypersensitive" (EHS) people worldwide self-report severely disabling, multiorgan, non-specific symptoms when exposed to low-dose electromagnetic radiations, **often associated with symptoms of multiple chemical sensitivity (MCS)** and/or other environmental "sensitivity-related illnesses" (SRI). This cluster of chronic inflammatory disorders still lacks validated pathogenetic mechanism, diagnostic biomarkers, and management guidelines. We hypothesized that SRI, not being merely psychogenic, may share organic determinants of impaired detoxification of common physico-chemical stressors. Based on our previous MCS studies, we tested a panel of 12 metabolic blood redox-related parameters and of selected drug-metabolizing-enzyme gene polymorphisms, on 153 EHS, 147 MCS, and 132 control Italians, confirming MCS altered ($P < 0.05$ - 0.0001) glutathione-(GSH), GSH-peroxidase/S-transferase, and catalase erythrocyte activities. **We first described comparable-though milder-metabolic pro-oxidant/proinflammatory alterations in EHS with distinctively increased plasma coenzyme-Q10 oxidation ratio.** Severe depletion of erythrocyte membrane polyunsaturated fatty acids with increased $\omega 6/\omega 3$ ratio was confirmed in MCS, but not in EHS. **We also identified significantly ($P = 0.003$) altered distribution-versus-control of the CYP2C19*1/*2 SNP variants in EHS, and a 9.7-fold increased risk (OR: 95% C.I. = 1.3-74.5) of developing EHS for the haplotype (null)GSTT1 + (null)GSTM1 variants.** Altogether, results on MCS and EHS strengthen our proposal to adopt this blood metabolic/genetic biomarkers' panel as suitable diagnostic tool for SRI.

100 Gangi and Johansson, 2000, Med Hypotheses. 2000 Apr;54(4):663-71.

A theoretical model based upon mast cells and histamine to explain the recently proclaimed sensitivity to electric and/or magnetic fields in humans.

<http://www.ncbi.nlm.nih.gov/pubmed/10859662>

The relationship between exposure to electromagnetic fields (EMFs) and human health is more and more in focus. This is mainly because of the rapid increasing use of such EMFs within our modern society. **Exposure to EMFs has been linked to different cancer forms, e.g. leukemia, brain tumors, neurological diseases, such as Alzheimer's disease, asthma and allergy, and recently to the phenomena of 'electrosensitivity' and 'screen dermatitis'.** There is an increasing number of reports about cutaneous problems as well as symptoms from internal organs, such as the heart, in people exposed to video display terminals (VDTs). These people suffer from subjective and objective skin and mucosa-related symptoms, such as itch, heat sensation, pain, erythema, papules and pustules. In severe cases, people can not, for instance, use VDTs or artificial light at all, or be close to mobile telephones. Mast cells (MCs), when activated, release a spectrum of mediators, among them histamine, which is involved in a variety of biological effects with clinical relevance, e.g. allergic hypersensitivity, itch, edema, local erythema and many types of dermatoses. From the results of recent studies, it is clear that EMFs affect the MC, and also the dendritic cell, population and may degranulate these cells. The release of inflammatory substances, such as histamine, from MCs in the skin results in a local erythema, edema and sensation of itch and pain, and the release of somatostatin from the dendritic cells may give rise to subjective sensations of on-going inflammation and sensitivity to ordinary light. These are, as mentioned, the common symptoms reported from patients suffering from 'electrosensitivity'/'screen dermatitis'. **MCs are also present in the heart tissue and their localization is of particular relevance to their function. Data from studies made on interactions of EMFs with the cardiac function have demonstrated that highly interesting changes are present in the heart after exposure to EMFs.** One could speculate that the cardiac MCs are responsible for these changes due to degranulation after exposure to EMFs. However, it is still not known how, and through which mechanisms, all these different cells are affected by EMFs. In this article, we present a theoretical model, based upon observations on EMFs and their cellular effects, to explain the proclaimed sensitivity to electric and/or magnetic fields in humans.

101 Griesz-Brisson M., 3rd International Conference on Neurology and Epidemiology, Neuroepidemiology 2013;41:223-316

Electrosensitivity from a neurological point of view

<http://www.karger.com/Article/Pdf/356326> (page 53)

Objective: The entity of electrosensitivity is still a new and a widely controversial topic in medicine. However, we cannot deny that we are increasingly confronted by patients with a variety of symptoms in the presence of cellphone transmitter masts, computers, cellphones and the like.

Method: 22 electrosensitive patients were tested and treated in a standardised way. The results were audited. Hair and urine was tested for essential elements (Mg, Se, Zn etc) and toxic heavy metals (Hg, Cd, Pb, etc.), blood was tested for genetic detoxification enzymes (Glutathion S-Transferase M1 and T1 und N-Acetyltransferase), blood was tested in the MELISA Test for hypersensitivity to heavy metals, EEG and brain mapping was performed as a baseline and in the presence of a cellphone held to the ear (but not talking), blood pressure and pulse were measured every 5 minutes with an automated blood pressure machine. Subjective symptoms were recoded in a questionnaire.

Results: There was a deficit in essential elements in 81.8% and an overload of toxic elements in 86.4% in the hair, genetic poly- morphism for GST T1 in 27.3%, GST M1 in 68.0%, GST T1 and M1 in 23% and NAT in 40.9%, hypersensitivity to heavy metals Ni59.1%, Au23.1%, Hg15.4%, Pd7.7%, Ag7.7%, Mo7.7%. **There was evidence of EEG, ECG and blood pressure changes** during and after exposure to electromagnetic fields induced by a mobile phone.

Conclusion: **The audit provided evidence that in electro- sensitive patients there is a deficiency in essential elements and an overload in toxic elements, genetic polymorphisms and hypersensitivities against heavy metals. The EEG/brain mapping showed that the brain reacts promptly in a paradoxical way and the cardio-vascular parameter changes (heart rate and rhythm, and blood pressure) were protracted in time. The questionnaire showed that the subjective symptoms started during exposure and continued after exposure stop.**

102 Havas and Marrongelle, 2013, Electromagn Biol Med. 2013 Jun;32(2):253-66.

Replication of heart rate variability provocation study with 2.4-GHz cordless phone confirms original findings.

<https://www.ncbi.nlm.nih.gov/pubmed/23675629>

Subjects were exposed to radiation for 3-min intervals **generated by a 2.4-GHz cordless phone base station** (3-8 $\mu\text{W}/\text{cm}^2$). A few participants had a severe reaction to the radiation with an increase in heart rate and altered HRV indicative of an alarm response to stress. Based on the HRV analyses of the 69 subjects, 7% were classified as being "moderately to very" sensitive, 29% were "little to moderately" sensitive, 30% were "not to little" sensitive and 6% were "unknown". **These results are not psychosomatic and are not due to electromagnetic interference.**

103 Havas M et al, 2010, European Journal of Oncology library Vol. 5, 273-300, part 2

Provocation study using heart rate variability shows microwave radiation from 2.45GHz cordless phone affects autonomic nervous system.

http://www.icems.eu/papers/ramazzini_library5_part2.pdf

This study provides scientific evidence that some individuals may experience arrhythmia, heart palpitations, heart flutter, or rapid heartbeat and/or vasovagal symptoms such as dizziness, nausea, profuse sweating and syncope when exposed to electromagnetic devices. It is the first study to demonstrate such a dramatic response to pulsed MW radiation at 0.5% of existing federal guidelines (1000 microW/cm2) in both Canada and the US.

[Exposure: 2.4 GHz (pulsed); continuous for 3 min; power flux density 3-5 $\mu\text{W}/\text{cm}^2$]

104 Landgrebe et al, 2009, PLoS One. 2009;4(3):e5026.

Association of tinnitus and electromagnetic hypersensitivity: hints for a shared pathophysiology?

<http://www.ncbi.nlm.nih.gov/pubmed/19325894>

BACKGROUND:

Tinnitus is a frequent condition with high morbidity and impairment in quality of life. The pathophysiology is still incompletely understood. Electromagnetic fields are discussed to be involved in the multi-factorial pathogenesis of tinnitus, but data proving this relationship are very limited. Potential health hazards of electromagnetic fields (EMF) have been under discussion for long. Especially, individuals claiming themselves to be electromagnetic hypersensitive suffer from a variety of unspecific symptoms, which they attribute to EMF-exposure. The aim of the study was to elucidate the relationship between EMF-exposure, electromagnetic hypersensitivity and tinnitus using a case-control design.

METHODOLOGY:

Tinnitus occurrence and tinnitus severity were assessed by questionnaires in 89 electromagnetic hypersensitive patients and 107 controls matched for age-, gender, living surroundings and workplace. Using a logistic regression approach, potential risk factors for the development of tinnitus were evaluated.

FINDINGS:

Tinnitus was significantly more frequent in the electromagnetic hypersensitive group (50.72% vs. 17.5%) whereas tinnitus duration and severity did not differ between groups. Electromagnetic hypersensitivity and tinnitus were

independent risk factors for sleep disturbances. However, measures of individual EMF-exposure like e.g. cell phone use did not show any association with tinnitus.

CONCLUSIONS:

Our data indicate that tinnitus is associated with subjective electromagnetic hypersensitivity. An individual vulnerability probably due to an over activated cortical distress network seems to be responsible for, both, electromagnetic hypersensitivity and tinnitus. Hence, therapeutic efforts should focus on treatment strategies (e.g. cognitive behavioral therapy) aiming at normalizing this dysfunctional distress network.

105 Landgrebe et al, 2008, Psychol Med. 2008 Dec;38(12):1781-91.

Cognitive and neurobiological alterations in electromagnetic hypersensitive patients: results of a case-control study.

<http://www.ncbi.nlm.nih.gov/pubmed/18366821>

BACKGROUND:

Hypersensitivity to electromagnetic fields (EMF) is frequently claimed to be linked to a variety of non-specific somatic and neuropsychological complaints. Whereas provocation studies often failed to demonstrate a causal relationship between EMF exposure and symptom formation, **recent studies point to a complex interplay of neurophysiological and cognitive alterations contributing to symptom manifestation in electromagnetic hypersensitive patients (EHS).** However, these studies have examined only small sample sizes or have focused on selected aspects. Therefore this study examined in the largest sample of EHS EMF-specific cognitive correlates, discrimination ability and neurobiological parameters in order to get further insight into the pathophysiology of electromagnetic hypersensitivity.

METHOD:

In a case-control design 89 EHS and 107 age- and gender-matched controls were included in the study. Health status and EMF-specific cognitions were evaluated using standardized questionnaires. Perception thresholds following single transcranial magnetic stimulation (TMS) pulses to the dorsolateral prefrontal cortex were determined using a standardized blinded measurement protocol. Cortical excitability parameters were measured by TMS.

RESULTS:

Discrimination ability was significantly reduced in EHS (only 40% of the EHS but 60% of the controls felt no sensation under sham stimulation during the complete series), whereas the perception thresholds for real magnetic pulses were comparable in both groups (median 21% versus 24% of maximum pulse intensity). Intra-cortical facilitation was decreased in younger and increased in older EHS. In addition, typical EMF-related cognitions (aspects of rumination, symptom intolerance, vulnerability and stabilizing self-esteem) specifically differentiated EHS from their controls.

CONCLUSIONS:

These results demonstrate significant cognitive and neurobiological alterations pointing to a higher genuine individual vulnerability of electromagnetic hypersensitive patients.

106 Landgrebe et al, 2007, Journal of Psychosomatic Research 62 (2007) 283-288

Altered cortical excitability in subjectively electrosensitive patients: Results of a pilot study

<http://www.sciencedirect.com/science/article/pii/S0022399906005095>

http://www.researchgate.net/publication/6481169_Altered_cortical_excitability_in_subjectively_electrosensitive_patients_results_of_a_pilot_study/file/d912f50a52e2932c78.pdf (full article)

Objective: Hypersensitivity to electromagnetic fields is frequently claimed to be linked to a variety of unspecific somatic and/or neuropsychological complaints. Whereas provocation studies often failed to demonstrate a causal relationship between electromagnetic field exposure and symptom formation, **neurophysiological examinations highlight baseline deviations in people claiming to be electrosensitive.**

Methods: To elucidate a potential role of dysfunctional cortical regulations in mediating hypersensitivity to electromagnetic fields, cortical excitability parameters were measured by transcranial magnetic stimulation in subjectively electrosensitive patients (n=23) and two control groups (n=49) differing in their level of unspecific health complaints.

Results: Electrosensitive patients showed reduced intracortical facilitation as compared to both control groups, while motor thresholds and intracortical inhibition were unaffected.

Conclusions: This pilot study gives additional evidence that altered central nervous system function may account for symptom manifestation in subjectively electrosensitive patients as has been postulated for several chronic multisymptom illnesses sharing a similar clustering of symptoms.

107 Lyskov et al, 2001, Int J Psychophysiol. 2001 Nov;42(3):233-41.

Neurophysiological study of patients with perceived 'electrical hypersensitivity'.

<http://www.ncbi.nlm.nih.gov/pubmed/11812390>

The aim of the present study was to investigate baseline neurophysiological characteristics of the central and autonomous regulation and their reactivity to different tests in a group of persons with so-called 'electrical hypersensitivity', which is often considered as a form of psychosomatic disorders. Twenty patients with combinations of neuroasthenic symptoms (general fatigue, weakness, dizziness, headache) and facial skin (itching, tingling, redness) have been investigated. An equal number of symptom-free persons served as a control group. The examination comprised self-reported measures, testing of visual functions, measurements of blood pressure, heart rate and its variability, electrodermal activity, respiration, EEG and visual evoked potentials (VEP). **Several variables were found to differ between the patient and the control groups. The mean value of heart rate in rest condition was higher in the patient group compared to the controls (mean value of inter-beat intervals were 0.80 and 0.90 s, respectively). Heart rate variability and response to standing test were decreased in the patient group compared to the controls. Patients had faster onset, higher amplitudes, and left-right hand asymmetry of the sympathetic skin responses. They had a higher critical fusion frequency (43 vs. 40 Hz), and a trend to increased amplitude of steady-state VEPs at stimulation frequencies of 30-70 Hz. The data indicated that the observed group of patients had a trend to hyper sympathotone, hyperresponsiveness to sensor stimulation and heightened arousal.**

108 Lyskov et al, 2001, Bioelectromagnetics. 2001 Oct;22(7):457-62.

Provocation study of persons with perceived electrical hypersensitivity and controls using magnetic field exposure and recording of electrophysiological characteristics.

<http://www.ncbi.nlm.nih.gov/pubmed/11568930>

The aim of the present study was to investigate possible neurophysiological effects of intermittent 15 sec on/off cycle, 60 Hz, 10 microT magnetic field exposure on patients with perceived "electromagnetic hypersensitivity" (EHS), and control subjects during rest and performance of a mental arithmetic task. Twenty participants (15 female, 5 male, 31-60 years old, mean 45.8 +/- 0.7 years) were invited from the group of EHS patients. Twenty volunteers (15 female, 5 male, 31-59 years old, mean 45.0 +/- 0.7 years?) served as a control group. The test protocol consisted of a set of examinations: EEG, visual evoked potentials, electrodermal activity, ECG, and blood pressure. The total duration of the test was 40 min, divided into two 10 min rest periods and two 10 min periods of mathematical performance. Magnetic field and sham exposures were presented randomly during these periods, resulting in four different conditions: Field-Rest, Sham-Rest, Field-Math, and Sham-Math. **The data showed significant main effects of the Group factor (EHS vs. control subjects) on heart rate ($F(1,80) = 20.6$; $P < 0.01$), heart rate spectrum ratio ($F(1,80) = 9.5$; $P = 0.02$), and electrodermal activity ($F(1,76) = 4.2$; $P = 0.04$), whereas EEG characteristics did not differ between groups. The Condition factor (mathematical task vs. relaxed) showed main effects for heart rate ($F(1,80) = 14.8$; $P < 0.01$), heart rate spectrum ratio ($F(1,80) = 7.8$; $P = 0.06$), electrodermal activity ($F(1,76) = 56.8$; $P < 0.01$), and alpha and theta spectral bands of EEG. Magnetic field exposure did not affect autonomous system or electroencephalographic variables of either group. These data do not indicate that EHS patients or control are affected by low-level 60 Hz magnetic field exposure. **However, persons reporting EHS differed from the control subjects in baseline values of investigated physiological characteristics. Perhaps EHS patients have a rather distinctive physiological predisposition to sensitivity to physical and psychosocial environmental stressors.****

109 Nordin et al, 2014, Int J Environ Res Public Health. 2014 Aug 27;11(9):8794-805.

Odor and noise intolerance in persons with self-reported electromagnetic hypersensitivity.

<http://www.ncbi.nlm.nih.gov/pubmed/25166918>

Lack of confirmation of symptoms attributed to electromagnetic fields (EMF) and triggered by EMF exposure has highlighted the role of individual factors. Prior observations indicate intolerance to other types of environmental exposures among persons with electromagnetic hypersensitivity (EHS). This study assessed differences in odor and noise intolerance between persons with EHS and healthy controls by use of subscales and global measures of the Chemical Sensitivity Scale (CSS) and the Noise Sensitivity Scale (NSS). The EHS group scored significantly higher than the controls on all CSS and NSS scales. Correlation coefficients between CSS and NSS scores ranged from 0.60 to 0.65 across measures. **The findings suggest an association between EHS and odor and noise intolerance, encouraging further investigation of individual factors for understanding EMF-related symptoms.**

110 Sandström et al, 2003, Int J Psychophysiol. 2003 Sep;49(3):227-35.

Holter ECG monitoring in patients with perceived electrical hypersensitivity.

<http://www.ncbi.nlm.nih.gov/pubmed/14507441>

Earlier studies have indicated that patients claiming to be sensitive to electromagnetic fields, so-called electrical hypersensitivity (EHS), have a dysbalance of the autonomic nervous system (ANS) regulation. This paper focuses on a possible dysbalance in the ANS among EHS patients by the use of long-term monitoring of electrocardiogram (ECG) in both a patient and a matched control group. At the same time, the environmental power frequency magnetic field was

recorded for both groups in order to see if there was any difference in exposure between the groups. ECG, heart rate (HR) and heart rate variability (HRV) as well as the magnetic field exposure were monitored for 24 h. Fourteen patients with perceived EHS symptoms were selected from the University Hospital, Umeå, Sweden. Symptoms indicating autonomic nervous dysregulation were not part of the inclusion criteria of the patient group. Age and sex matched healthy subjects were used as controls. No differences were found between the groups regarding magnetic field exposure or the mean HR for 24 h. **The HRV analyses showed that the high-frequency (HF) component did not have the expected increase with sleep onset and during nighttime in the EHS group. When separating the sleeping and awake time even less differences between the two conditions in the EHS patients, both for the low-frequency and HF components in the HRV spectrum, were seen. EHS patients had a disturbed pattern of circadian rhythms of HRV and showed a relatively 'flat' representation of hourly-recorded spectral power of the HF component of HRV.**

111 Yoshiaki Omura M.D., Sc.D.

Abnormal Deposits of Al, Pb, and Hg in the Brain, Particularly in the Hippocampus, as One of the Main Causes of Decreased Cerebral Acetylcholine, Electromagnetic Field Hypersensitivity, Pre-Alzheimer's Disease, and Autism in Children and Their New Effective Treatment by Removing These Metal Deposits Using Cilantro and the Selective Drug Uptake Enhancement Method (Part I). The journal Acupuncture & Electro-Therapeutics Research, 2000, Vol. 25 Issue ¾

<https://www.cognizantcommunication.com/ccsSiteFiles/Acupuncture/acutoc25.html>

112 Wilén et al, 2006, Bioelectromagnetics. 2006 Apr;27(3):204-14.

Psychophysiological tests and provocation of subjects with mobile phone related symptoms.

<http://www.ncbi.nlm.nih.gov/pubmed/16304699>

The aim of the present study was to investigate the effect of exposure to a mobile phone-like radiofrequency (RF) electromagnetic field on persons experiencing subjective symptoms when using mobile phones (MP). Twenty subjects with MP-related symptoms were recruited and matched with 20 controls without MP-related symptoms. Each subject participated in two experimental sessions, one with true exposure and one with sham exposure, in random order. In the true exposure condition, the test subjects were exposed for 30 min to an RF field generating a maximum SAR(1g) in the head of 1 W/kg through an indoor base station antenna attached to a 900 MHz GSM MP. The following physiological and cognitive parameters were measured during the experiment: heart rate and heart rate variability (HRV), respiration, local blood flow, electrodermal activity, critical flicker fusion threshold (CFFT), short-term memory, and reaction time. No significant differences related to RF exposure conditions were detected. Also no differences in baseline data were found between subject groups, **except for the reaction time, which was significantly longer among the cases than among the controls the first time the test was performed.** This difference disappeared when the test was repeated. **However, the cases differed significantly from the controls with respect to HRV as measured in the frequency domain. The cases displayed a shift in low/high frequency ratio towards a sympathetic dominance in the autonomous nervous system during the CFFT and memory tests, regardless of exposure condition. This might be interpreted as a sign of differences in the autonomous nervous system regulation between persons with MP related subjective symptoms and persons with no such symptoms.**

[Exposure: 900 MHz; 30 mins; SAR 1 W/kg]

113 Electromagnetic Hypersensitivity

Proceedings International Workshop on EMF Hypersensitivity Prague, Czech Republic October 25-27, 2004

Editors Kjell Hansson Mild Mike Repacholi Emilie van Deventer Paolo Ravazzani

http://www.who.int/peh-emf/publications/reports/EHS_Proceedings_June2006.pdf

Workshop Summary, Recommendations for medical evaluation (Page 3)

Some studies suggest that certain physiological responses of IEI individuals tend to be outside the normal range. In particular, the findings of hyper reactivity in the central nervous system and misbalance in the autonomic nervous system need to be followed up in clinical investigations and the results for the individuals taken as input for possible treatment.

EHS PAPERS DEMONSTRATING GENETIC VARIATIONS:

See also: De Luca 2014⁹⁹.

MECHANISMS:

See also: Andrzejak 2008⁴⁴, Belpomme 2014⁹⁶, Gangi & Johansson 2000¹⁰⁰, Khullar 2013⁵², Lustenberger 2013⁸⁷, Maby 2006⁵⁵, Maier 2004⁵⁶, Mian 2013⁷⁸, Papageorgiou 2011⁴², Patel 2008⁸¹, Perentos 2013⁸⁸, Regel 2007⁶², Schmid 2012⁶⁵, Vecchio 2010⁶⁹.

114 American Academy of Environmental Medicine (AAEM), 2012

Electromagnetic and Radiofrequency Fields Effect on Human Health (Dec 2012)

http://aaemonline.org/emf_rf_position.html

Electromagnetic field (EMF) hypersensitivity has been documented in controlled and double blind studies with exposure to various EMF frequencies. Rea et al. demonstrated that under double blind placebo controlled conditions, 100% of subjects showed reproducible reactions to that frequency to which they were most sensitive. Pulsed electromagnetic frequencies were shown to consistently provoke neurological symptoms in a blinded subject while exposure to continuous frequencies did not.

Although these studies clearly show causality and disprove the claim that health effects from RF exposure are uncertain, there is another mechanism that proves electromagnetic frequencies, including radiofrequencies, can negatively impact human health. Government agencies and industry set safety standards based on the narrow scope of Newtonian or "classical" physics reasoning that the effects of atoms and molecules are confined in space and time. This model supports the theory that a mechanical force acts on a physical object and thus, long-range exposure to EMF and RF cannot have an impact on health if no significant heating occurs. However, this is an incomplete model. A quantum physics model is necessary to fully understand and appreciate how and why EMF and RF fields are harmful to humans. In quantum physics and quantum field theory, matter can behave as a particle or as a wave with wave-like properties. Matter and electromagnetic fields encompass quantum fields that fluctuate in space and time. These interactions can have long-range effects which cannot be shielded, are non-linear and by their quantum nature have uncertainty. Living systems, including the human body, interact with the magnetic vector potential component of an electromagnetic field such as the field near a toroidal coil. The magnetic vector potential is the coupling pathway between biological systems and electromagnetic fields. Once a patient's specific threshold of intensity has been exceeded, it is the frequency which triggers the patient's reactions.

Long range EMF or RF forces can act over large distances setting a biological system oscillating in phase with the frequency of the electromagnetic field so it adapts with consequences to other body systems. This also may produce an electromagnetic frequency imprint into the living system that can be long lasting. Research using objective instrumentation has shown that even passive resonant circuits can imprint a frequency into water and biological systems. These quantum electrodynamic effects do exist and may explain the adverse health effects seen with EMF and RF exposure. These EMF and RF quantum field effects have not been adequately studied and are not fully understood regarding human health.

115 Austrian Medical Association, 2012

Guideline of the Austrian Medical Association for diagnosis and treatment of EMF-related health problems and illnesses (EMF Syndrome)

<http://www.magdahavas.com/wordpress/wp-content/uploads/2012/06/Austrian-EMF-Guidelines-2012.pdf>

Background (page 3)

Based on the scientific literature on interactions of EMF with biological systems, several mechanisms of interaction are possible. A plausible mechanism at the intracellular and intercellular level, for instance, is interaction via the formation of free radicals or oxidative and nitrosative stress (Friedmann et al. 2007, Simkó 2007, Pall 2007, Bedard and Krause 2007, Pacher et al. 2007, Desai et al. 2009). It centres on the increased formation of peroxynitrite (ONOO-) from a reaction of nitrogen monoxide (NO) with superoxide (O2-). Due to its relatively long half-life, peroxynitrite damages a large number of essential metabolic processes and cell components.

116 Canadian Human Rights Commission, May 2007

The Medical Perspective on Environmental Sensitivities

http://www.chrc-ccdp.gc.ca/sites/default/files/envsensitivity_en.pdf

B Possible explanations (page 23)

a) Chemical exposures

Healthy bodily functions depend upon chemical (e.g. hormonal) as well as electrical signals to keep all systems (e.g. circulatory, digestive, endocrine, respiratory and nervous systems) working harmoniously. Foreign chemicals can mimic signalling chemicals such as hormones (e.g. estrogen,

thyroid hormones, testosterone), thereby sending the wrong messages or blocking their transmission.... Natural or synthetic chemicals may also affect biochemical pathways and development via “epigenetics,” whereby genes are marked to be “read” or “silenced.” These changes may be passed to successive generations.

[Author’s note: EMF can also interfere with signalling and epigenetics in a similar way.]

b) Neural sensitization

The high prevalence of neurological symptoms in people with environmental sensitivities led to interest in “kindling” within the nervous system. **Kindling is a phenomenon whereby repeated low level exposures to chemicals, or electromagnetic currents or fields eventually cause symptoms at levels previously tolerated.** In this process, neurochemical, behavioural, endocrine and/or immunological responses are amplified.

The limbic system is identified as a target for kindling. This is a basic part of the brain, governing autonomic functions that maintain biological homeostasis. It is involved with the sense of smell, sleep, emotions and behaviour, as well as learning and short-term memory. The limbic system can become sensitized to stressors, and once sensitized will react even to very weak stimuli, eliciting symptoms as seen in environmental sensitivities. The limbic system of the brain is affected directly from the nose via the olfactory nerve, and by inhaled chemicals that bypass the blood-brain barrier.

117 Desai et al, 2009, Biol Endocrinol. 2009; 7: 114

Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on male reproductive system

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2776019/>

A review of scientific research.

Conclusion: We have reviewed the literature to better understand the effects of cell phone radiation on human health, especially on fertility and in relation to cancer. Commercially available cellular phones might affect cell function via non-thermal effects. We hypothesized that the plasma membrane might be the target of cell phone radiation. **RF-EMW can increase ROS formation by increasing the activity of plasma membrane NADH oxidase. Prolonged exposure to RF-EMW can also cause DNA damage (by prolonged OS), which may accelerates neuronal and spermatozoal cell death and promote neurodegenerative processes as well as promote brain and testicular carcinogenesis. Any tumor promoting effects of RF-EMW might be due to the effect it has on PKC, ODC, intra cellular calcium spikes and stimulation of stress kinase. Stimulation of plasma membrane NADH oxidase might play central role in above mentioned effects.**

OS and changes in PKC activity might lead to the RF-EMW related infertility observed in numerous studies. Hence, RF-EMW from commercially available cell phones might affect the fertilizing potential of spermatozoa. Therefore, the SAR limit (maximum acceptable exposure limit) should be lowered for cellular phones. However, more studies are necessary to provide definitive evidence against cell phone radiation, which can be provided by in vitro studies combined with computational biomodeling.

118 Elder & Chou, 2003, Bioelectromagnetics. 2003;Suppl 6:S162-73.

Auditory response to pulsed radiofrequency energy.

<http://www.ncbi.nlm.nih.gov/pubmed/14628312>

The human auditory response to pulses of radiofrequency (RF) energy, commonly called RF hearing, is a well established phenomenon. RF induced sounds can be characterized as low intensity sounds because, in general, a quiet environment is required for the auditory response. The sound is similar to other common sounds such as a click, **buzz, hiss, knock, or chirp.** Effective radiofrequencies range from 2.4 to 10000 MHz, but an individual's ability to hear RF induced sounds is dependent upon high frequency acoustic hearing in the kHz range above about 5 kHz. The site of conversion of RF energy to acoustic energy is within or peripheral to the cochlea, and once the cochlea is stimulated, the detection of RF induced sounds in humans and RF induced auditory responses in animals is similar to acoustic sound detection. **The fundamental frequency of RF induced sounds is independent of the frequency of the radiowaves but dependent upon head dimensions. The auditory response has been shown to be dependent upon the energy in a single pulse and not on average power density. The weight of evidence of the results of human, animal, and modeling studies supports the thermoelastic expansion theory as the explanation for the RF hearing phenomenon. RF induced sounds involve the perception via bone conduction of thermally generated sound transients, that is, audible sounds are produced by rapid thermal expansion resulting from a calculated temperature rise of only 5×10^{-6} degrees C in tissue at the threshold level due to absorption of the energy in the RF pulse.** The hearing of RF induced sounds at exposure levels many orders of magnitude greater than the hearing threshold is considered to be a biological effect without an accompanying health effect. This conclusion is supported by a comparison of pressure induced in the body by RF pulses to pressure associated with hazardous acoustic energy and clinical ultrasound procedures.

[Author's note: it is possible that the now widely reported tinnitus associated with EHS, but also noted in the general population in a dose response fashion to, for example mobile phone exposure, could be caused by this mechanism.]

119 Friedman et al, 2007, Biochem J. 2007 Aug 1;405(3):559-68.

Mechanism of short-term ERK activation by electromagnetic fields at mobile phone frequencies.

<http://www.ncbi.nlm.nih.gov/pubmed/17456048>

The exposure to non-thermal microwave electromagnetic fields generated by mobile phones affects the expression of many proteins. This effect on transcription and protein stability can be mediated by the MAPK (mitogen-activated protein kinase) cascades, which serve as central signalling pathways and govern essentially all stimulated cellular processes. **Indeed, long-term exposure of cells to mobile phone irradiation results in the activation of p38 as well as the ERK (extracellular-signal-regulated kinase) MAPKs.** In the present study, we have studied the immediate effect of irradiation on the MAPK cascades, and found that ERKs, but not stress-related MAPKs, are rapidly activated in response to various frequencies and intensities. Using signalling inhibitors, we delineated the mechanism that is involved in this activation. **We found that the first step is mediated in the plasma membrane by NADH oxidase, which rapidly generates ROS (reactive oxygen species). These ROS then directly stimulate MMPs (matrix metalloproteinases) and allow them to cleave and release Hb-EGF [heparin-binding EGF (epidermal growth factor)]. This secreted factor activates the EGF receptor, which in turn further activates the ERK cascade. Thus this study demonstrates for the first time a detailed molecular mechanism by which electromagnetic irradiation from mobile phones induces the activation of the ERK cascade and thereby induces transcription and other cellular processes.**

120 Genuis and Lipp, 2012, Sci Total Environ. 2012 Jan 1;414:103-12.

Electromagnetic hypersensitivity: fact or fiction?

<http://www.ncbi.nlm.nih.gov/pubmed/22153604>

Some scientists and clinicians acknowledge the phenomenon of hypersensitivity to EMR resulting from common exposures such as wireless systems and electrical devices in the home or workplace; others suggest that electromagnetic hypersensitivity (EHS) is psychosomatic or fictitious. Various organizations including the World Health Organization as well as some nation states are carefully exploring this clinical phenomenon in order to better explain the rising prevalence of non-specific, multi-system, often debilitating symptoms associated with non-ionizing EMR exposure. As well as an assortment of physiological complaints, patients diagnosed with EHS also report profound social and personal challenges, impairing their ability to function normally in society. This paper offers a review of the sparse literature on this perplexing condition and a discussion of the controversy surrounding the legitimacy of the EHS diagnosis. Recommendations are provided to assist health professionals in caring for individuals complaining of EHS.

[Author's note: In Section 2.3 Pathogenesis of Electromagnetic Hypersensitivity Genuis describes a) sensitivity related illness (toxicant induced loss of tolerance, Tilt), b) Catecholamine dysregulation].

121 Khamidova, 2014, International Journal of BioMedicine 4(3) (2014) 155-158

The Influence of Radiofrequency Electromagnetic Radiation on the Platelet Aggregation

http://ijbm.org/articles/Article4_3_CR5.pdf

Abstract

The purpose of this study was to examine the impact of radiofrequency electromagnetic fields (RF-EMFs) on platelet aggregation (PA) in individuals working for a long time under a direct and continuous RF-EMF exposure. We examined 119 persons aged from 22 to 65 years. In individuals working under the direct and constant exposure to RF-EMFs, the various changes of PA with a predominance of hyperaggregation are detected. The dependence of the changes in the indicators of PA on length of work in conditions of RF-EMF exposure is determined.

INTRODUCTION

Recently, it has been shown that RF-EMFs with extremely high frequencies may influence practically all known types of cells in systems of arbitrary organization levels of living material.

RESULTS AND DISCUSSION

We have noted significant differences in the parameters of the intensity and the rate of PA in the persons working under the influence of RF-EMF compared with healthy volunteers (Table 1). The rate of PA in Groups III-VI was significantly different from the control values, i.e. in persons working for over 11 years under the influence of RF-EMF. It is known that the cell generates EMF of a wide range during one's lifetime. The millimeter and submillimeter ranges were used by the cells for information exchange, which is necessary for the regulation of intracellular functions and cell-cell interactions. This is supported by the appearance of a number of effects, both in individual cells and the whole organism, in response to RF-EMF. Under the RF-EMF exposure, the directed displacement of ions, the redistribution of electric charges, and polarization take place. Oscillatory motion of the charged corpuscles lead to different intramolecular physicochemical and structural adjustments, promoting change in the functional activity of cells,

including platelets. As a result, the nonspecific metabolic reactions (phosphorylation of proteins, receptor activation) determining the hyperactivity of platelets consistently occur in platelets, which are lined up in the form of the “sludge” chain in parallel to the force lines of the electrical field. Thus, the structure of the cell membrane is changed: the membrane is destroyed and intermolecular bonds are ruptured. Platelet-derived factors, such as adenosine diphosphate, thromboxane A₂, serotonin and others, are activated. Changes in the structure of the platelet membrane lead to the activation of the receptor complex GPIIb/IIIa, which mediates PA. The emergence of a large number of circulating platelet aggregates impairs blood rheology and microcirculation. The blockage of microcirculation is accompanied by impaired functioning of organs and systems. It is also known there are low-frequency bio-currents in the human body. The heart generates electrical oscillations with frequencies from 30 to 700Hz and the brain from 200 to 500Hz. If the frequency of bio-currents coincides with the frequency of the EMF, the bio-currents are distorted, which leads to disruption of normal functioning of the body. Microcirculatory disorders and hyperactivity of platelets further exacerbate this situation.

CONCLUSION

The results of our study confirm the deleterious effect RF-EMF both on the blood cells and on blood rheology. In individuals working under the direct and constant exposure to RF-EMFs, the various changes of PA with a predominance of hyperaggregation are detected.

122 McCarty et al, Int J Neurosci. 2011 Dec;121(12):670-6.

Electromagnetic hypersensitivity: evidence for a novel neurological syndrome.

<http://www.ncbi.nlm.nih.gov/pubmed/21793784>

<http://andrewamarino.com/PDFs/171-IntJNeurosci2011.pdf> (full paper)

Introduction

The underlying mechanism of field sensory transduction appears to be an electric-force-sensitive ion channel (Marino, Carrubba, Frilot, & Chesson, 2009). Animal studies suggest that the electroreceptor cells and/or afferent processing cells are located in the brain stem (Frilot, Carrubba, & Marino, 2009, 2011).

123 Pacher et al, 2007, Physiol Rev. 2007 Jan;87(1):315-424.

<http://www.ncbi.nlm.nih.gov/pubmed/17237348>

Nitric oxide and peroxynitrite in health and disease.

The discovery that mammalian cells have the ability to synthesize the free radical nitric oxide (NO) has stimulated an extraordinary impetus for scientific research in all the fields of biology and medicine. Since its early description as an endothelial-derived relaxing factor, NO has emerged as a fundamental signaling device regulating virtually every critical cellular function, as well as a potent mediator of cellular damage in a wide range of conditions. Recent evidence indicates that most of the cytotoxicity attributed to NO is rather due to peroxynitrite, produced from the diffusion-controlled reaction between NO and another free radical, the superoxide anion. **Peroxyntirite interacts with lipids, DNA, and proteins via direct oxidative reactions or via indirect, radical-mediated mechanisms. These reactions trigger cellular responses ranging from subtle modulations of cell signaling to overwhelming oxidative injury, committing cells to necrosis or apoptosis. In vivo, peroxynitrite generation represents a crucial pathogenic mechanism in conditions such as stroke, myocardial infarction, chronic heart failure, diabetes, circulatory shock, chronic inflammatory diseases, cancer, and neurodegenerative disorders.** Hence, novel pharmacological strategies aimed at removing peroxynitrite might represent powerful therapeutic tools in the future. Evidence supporting these novel roles of NO and peroxynitrite is presented in detail in this review.

[Author's note: Peroxynitrite can be increased in response to RF EMF].

124 Pall, 2013, J Cell Mol Med. 2013 Aug;17(8):958-65.

Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects.

<http://www.ncbi.nlm.nih.gov/pubmed/23802593>

<http://onlinelibrary.wiley.com/doi/10.1111/jcmm.12088/full>

The direct targets of extremely low and microwave frequency range electromagnetic fields (EMFs) in producing non-thermal effects have not been clearly established. However, studies in the literature, reviewed here, provide substantial support for such direct targets. **Twenty-three studies have shown that voltage-gated calcium channels (VGCCs) produce these and other EMF effects**, such that the L-type or other VGCC blockers block or greatly lower diverse EMF effects. **Furthermore, the voltage-gated properties of these channels may provide biophysically plausible mechanisms for EMF biological effects. Downstream responses of such EMF exposures may be mediated through Ca(2+) /calmodulin stimulation of nitric oxide synthesis. Potentially, physiological/therapeutic responses may be largely as a result of nitric oxide-cGMP-protein kinase G pathway stimulation.** A well-studied example of such an apparent therapeutic response, EMF stimulation of bone growth, appears to work along this pathway. However,

pathophysiological responses to EMFs may be as a result of nitric oxide-peroxynitrite-oxidative stress pathway of action. A single such well-documented example, EMF induction of DNA single-strand breaks in cells, as measured by alkaline comet assays, is reviewed here. Such single-strand breaks are known to be produced through the action of this pathway. Data on the mechanism of EMF induction of such breaks are limited; what data are available support this proposed mechanism. **Other Ca(2+) -mediated regulatory changes, independent of nitric oxide, may also have roles. This article reviews, then, a substantially supported set of targets, VGCCs, whose stimulation produces non-thermal EMF responses by humans/higher animals with downstream effects involving Ca(2+) /calmodulin-dependent nitric oxide increases, which may explain therapeutic and pathophysiological effects.**

[Author's note: These voltage gated calcium channel changes have been implicated by Professor Pall in the development of EHS. Ref: BSEM conference video March 2014].

125 Redmayne & Johansson, 2014, J Toxicol Environ Health B Crit Rev. 2014;17(5):247-58.

Could myelin damage from radiofrequency electromagnetic field exposure help explain the functional impairment electrohypersensitivity? A review of the evidence.

<http://www.ncbi.nlm.nih.gov/pubmed/25205214>

Myelin provides the electrical insulation for the central and peripheral nervous system and develops rapidly in the first years of life, but continues into mid-life or later. Myelin integrity is vital to healthy nervous system development and functioning. This review outlines the development of myelin through life, and then considers the evidence for an association between myelin integrity and exposure to low-intensity radiofrequency electromagnetic fields (RF-EMFs) typical in the modern world. **In RF-EMF peer-reviewed literature examining relevant impacts such as myelin sheath, multiple sclerosis, and other myelin-related diseases, cellular examination was included. There are surprisingly little data available in each area, but considered together a picture begins to emerge in RF-EMF-exposed cases: (1) significant morphological lesions in the myelin sheath of rats; (2) a greater risk of multiple sclerosis in a study subgroup; (3) effects in proteins related to myelin production; and (4) physical symptoms in individuals with functional impairment electrohypersensitivity, many of which are the same as if myelin were affected by RF-EMF exposure, giving rise to symptoms of demyelination.** In the latter, there are exceptions; headache is common only in electrohypersensitivity, while ataxia is typical of demyelination but infrequently found in the former group. **Overall, evidence from in vivo and in vitro and epidemiological studies suggests an association between RF-EMF exposure and either myelin deterioration or a direct impact on neuronal conduction, which may account for many electrohypersensitivity symptoms. The most vulnerable are likely to be those in utero through to at least mid-teen years, as well as ill and elderly individuals.**

Extract from full paper (p248):

In yet unpublished studies by Johansson et al. (personal communication), the epidermal nerve fibers of electrohypersensitive persons were markedly reduced in length and number of nerve terminals, indicating apparent damage.

Extract from full paper (p255):

Overall, evidence suggests an association between RF-EMF exposure and either myelin deterioration or a direct impact on neuronal conduction, which may account for many electrohypersensitivity symptoms. The question is whether this occurred due to myelin sheath destruction or functional axonal conduction disruption. In neuroscience it is a well-established fact that reduction of the number of nerve fibers and concomitantly axonal terminals leads to an elevation in sensitivity, the so-called supersensitivity phenomenon (Gerfen, 2003). Can these also be underlying mechanisms for electrohypersensitivity?

126 Simkó M., 2007, Curr Med Chem. 2007;14(10):1141-52.

Cell type specific redox status is responsible for diverse electromagnetic field effects.

<http://www.ncbi.nlm.nih.gov/pubmed/17456027>

Epidemiologic and experimental research on the potential carcinogenic effects of extremely low frequency electromagnetic fields (ELF-EMF) has been performed for a long time. Epidemiologic studies regarding ELF-EMF-exposure have focused primarily on leukaemia development due to residential sources in children and adults, and from occupational exposure in adults, but also on other kinds of cancer. Genotoxic investigations of EMF have shown contradictory results, a biological mechanism is still lacking that can explain the link between cancer development and ELF-EMF-exposure. Recent laboratory research has attempted to show general biological effects, and such that could be related to cancer development and/or promotion. Metabolic processes which generate oxidants and antioxidants can be influenced by environmental factors, such as ELF-EMF. Increased ELF-EMF exposure can modify the activity of the organism by reactive oxygen species leading to oxidative stress. **It is well established that free radicals can interact with DNA resulting in single strand breaks. DNA damage could become a site of mutation, a key step to carcinogenesis. Furthermore, different cell types react differently to the same stimulus, because of their cell type**

specific redox status. The modulation of cellular redox balance by the enhancement of oxidative intermediates, or the inhibition or reduction of antioxidants, is discussed in this review. **An additional aspect of free radicals is their function to influence other illnesses such as Parkinson's and Alzheimer's diseases. On the other hand, modulation of antioxidants by ELF-EMF can lower the intracellular defence activity promoting the development of DNA damage. It has also been demonstrated that low levels of reactive oxygen species trigger intracellular signals that involve the transcription of genes and leading to responses including cell proliferation and apoptosis.** In this review, a general overview is given about oxidative stress, as well as experimental studies are reviewed as they are related to changes in oxidant and antioxidant content after ELF-EMF exposure inducing different biological effects. **Finally, we conclude from our review that modulations on the oxidant and antioxidant level through ELF-EMF exposure can play a causal role in cancer development.**

[Author's note: this study concerns ELF EMF].

RECOGNISED AS PHYSIOLOGICAL CONDITION:

127 American Academy of Environmental Medicine (AAEM)

Electromagnetic and Radiofrequency Fields Effect on Human Health (Dec 2012)

http://aaemonline.org/emf_rf_position.html

For over 50 years, the American Academy of Environmental Medicine (AAEM) has been studying and treating the effects of the environment on human health. In the last 20 years, our physicians began seeing patients who reported that electric power lines, televisions and other electrical devices caused a wide variety of symptoms. **By the mid 1990's, it became clear that patients were adversely affected by electromagnetic fields and becoming more electrically sensitive. In the last five years with the advent of wireless devices, there has been a massive increase in radiofrequency (RF) exposure from wireless devices as well as reports of hypersensitivity and diseases related to electromagnetic field and RF exposure. Multiple studies correlate RF exposure with diseases such as cancer, neurological disease, reproductive disorders, immune dysfunction, and electromagnetic hypersensitivity.**

...Electromagnetic field (EMF) hypersensitivity has been documented in controlled and double blind studies with exposure to various EMF frequencies. Rea et al. demonstrated that under double blind placebo controlled conditions, 100% of subjects showed reproducible reactions to that frequency to which they were most sensitive. Pulsed electromagnetic frequencies were shown to consistently provoke neurological symptoms in a blinded subject while exposure to continuous frequencies did not. ...

Although these studies clearly show causality and disprove the claim that health effects from RF exposure are uncertain, there is another mechanism that proves electromagnetic frequencies, including radiofrequencies,...

Furthermore, the AAEM asks for:

- An immediate caution on Smart Meter installation due to potentially harmful RF exposure.
- Accommodation for health considerations regarding EMF and RF exposure, including exposure to wireless Smart Meter technology.
- Independent studies to further understand the health effects from EMF and RF exposure.
- **Recognition that electromagnetic hypersensitivity is a growing problem worldwide.**
- Understanding and control of this electrical environmental bombardment for the protection of society.
- Consideration and independent research regarding the quantum effects of EMF and RF on human health.
- Use of safer technology, including for Smart Meters, such as hard-wiring, fiber optics or other non-harmful methods of data transmission.

128 Austrian Medical Association, 2012

Guideline of the Austrian Medical Association for diagnosis and treatment of EMF-related health problems and illnesses (EMF Syndrome)

<http://www.magdahavas.com/wordpress/wp-content/uploads/2012/06/Austrian-EMF-Guidelines-2012.pdf>

129 Bioinitiative Report, 2014, Summary for the Public (2014 Supplement)

A report by 29 independent scientists and health experts from around the world (ten holding medical degrees (MDs), 21 PhDs, and three MSc, MA or MPHs) about possible risks from wireless technologies and electromagnetic fields. Among the authors are three former presidents of the Bioelectromagnetics Society (BEMS), and five full members of

BEMS. One distinguished author is the Chair of the Russian National Committee on Non-Ionizing Radiation. Another is a Senior Advisor to the European Environmental Agency.

http://www.bioinitiative.org/report/wp-content/uploads/pdfs/sec01_2012_summary_for_public.pdf

II. SUMMARY OF THE SCIENCE

E. Evidence for Electrohypersensitivity

What is evident is that a growing number of people world-wide have serious and debilitating symptoms that key to various types of EMF and RFR exposure. Of this there is little doubt. The continued massive rollout of wireless technologies, in particular the wireless 'smart' utility meter, has triggered thousands of complaints of ill-health and disabling symptoms when the installation of these meters is in close proximity to family home living spaces.

130 Canadian Human Rights Commission, May 2007

The Medical Perspective on Environmental Sensitivities

http://www.chrc-ccdp.gc.ca/sites/default/files/envsensitivity_en.pdf

Executive Summary (page iv)

Research indicates that sensitivities generally have physical causes, with many neurological and psycho-social factors interwoven. Successfully addressing physical symptoms with safe housing, workplaces, food and water may also alleviate psychological symptoms. This is necessary before other psychosocial interventions may be helpful.

Summary (page 26)

The balance of scientific evidence and experience indicates that environmental sensitivities generally arise from physiological causes, although there are many neurological and psychological consequences.

131 Freiburger Appeal, 2002

More than 1000 physicians signed the "Freiburg Appeal" in 2002. It was translated into many languages. As many as 36,000 people from all over the world support its warning about the dangers of radio-frequency radiation.

http://www.powerwatch.org.uk/pdfs/20021019_englisch.pdf

Out of great concern for the health of our fellow human beings do we - as established physicians of all fields, especially that of environmental medicine - turn to the medical establishment and those in public health and political domains, as well as to the public.

We have observed, in recent years, a dramatic rise in severe and chronic diseases among our patients, especially:

- Learning, concentration, and behavioural disorders (e.g. attention deficit disorder, ADD)
- Extreme fluctuations in blood pressure, ever harder to influence with medications
- Heart rhythm disorders
- Heart attacks and strokes among an increasingly younger population
- Brain-degenerative diseases (e.g. Alzheimer-s) and epilepsy
- Cancerous afflictions: leukemia, brain tumors

Moreover, we have observed an ever-increasing occurrence of various disorders, often misdiagnosed in patients as psychosomatic:

- Headaches, migraines
- Chronic exhaustion
- Inner agitation
- Sleeplessness, daytime sleepiness
- Tinnitus
- Susceptibility to infection
- Nervous and connective tissue pains, for which the usual causes do not explain even the most conspicuous symptoms

Since the living environment and lifestyles of our patients are familiar to us, we can see - especially after carefully-directed inquiry - a clear temporal and spatial correlation between the appearance of disease and exposure to pulsed high -frequency microwave radiation (HFMR), such as:

- Installation of a mobile telephone sending station in the near vicinity
- Intensive mobile telephone use

· Installation of a digital cordless (DECT) telephone at home or in the neighbourhood

We can no longer believe this to be purely coincidence, for:

· Too often do we observe a marked concentration of particular illnesses in correspondingly HFMR-polluted areas or apartments;

· Too often does a long-term disease or affliction improve or disappear in a relatively short time after reduction or elimination of HFMR pollution in the patient's environment;

· Too often are our observations confirmed by on-site measurements of HFMR of unusual intensity.

On the basis of our daily experiences, we hold the current mobile communications technology (introduced in 1992 and since then globally extensive) and cordless digital telephones (DECT standard) to be among the fundamental triggers for this fatal development.

One can no longer evade these pulsed microwaves. They heighten the risk of already-present chemical/physical influences, stress the body's immune system, and can bring the body's still-functioning regulatory mechanisms to a halt. Pregnant women, children, adolescents, elderly and sick people are especially at risk.

132 International Doctors Appeal, 2012

http://freiburger-appell-2012.info/media/International_Doctors_Appeal_2012_Nov.pdf

II. Appeal:

As physicians and scientists, we hereby call on our colleagues; on the leaders of federal, state, and local governments; but also on the wider community to take action and implement the following precautionary strategies, which also include fundamental human rights:

1. Protect the inviolability of the home by minimizing radio-frequency exposure levels, which penetrate through the walls of one's own home.
2. Ensure considerably lower radio-frequency radiation exposures as well as exposure limits that reliably protect humans and nature from adverse biological effects of electromagnetic fields. Any further expansion of wireless technologies is irresponsible.
3. Prefer wired solutions for home use and public institutions, especially at preschools, schools, colleges, universities, nursing homes, and hospitals.
4. Cutback and reprogram continuously emitting devices such as cordless phones, wireless Internet access (Wi-Fi), and wireless smart meters so that they only operate and emit radio-frequency radiation on demand when being used.
5. Provide special protection for children and adolescents: Children below the age of 8 should not use cell phones and cordless phones; children and adolescents between the ages 8 and 16 should also not use cell phones or only use them in the case of an emergency. Cell phone and online device advertisements must not be directed at children and adolescents, and these devices should not be used at schools.
6. Attach clearly visible warning labels and safety guidelines for lowering the radiation exposure on cell phones and other wireless devices, including instruction manuals. An important reminder: do not carry a cell phone right next to your body when it is turned on.
7. **Identify and clearly mark protected zones for electrosensitive people; establish public areas without wireless access or coverage, especially on public transport, similar to smoke-free areas for nonsmokers.**
8. Promote the development of communication technologies and electricity use that is more compatible with health. Prefer wired solutions for home use and public facilities. Expand fiber-optic networks as the foundation of a modern, sustainable, and performance-based technology that meets the ever-increasing demand for higher data transmission rates.
9. Provide government funding for industry-independent research and education that do not dismiss strong scientific and medical findings of potential risks, but rather work to clarify those risks.

At the same time, we also call on everyone who cares about health and the environment:

Make wise consumer choices and thus help reduce exposure levels. Favor wired communication technologies. Inform yourself and pass this knowledge on to your family, neighbors, friends, and politicians. Get involved and make a difference so that the protection of human health and the environment is not left to and limited by commercial

interests.

133 Huss & Rössli, 2006, BMC Public Health. 2006 Oct 30;6:267.

Consultations in primary care for symptoms attributed to electromagnetic fields--a survey among general practitioners.

<http://www.ncbi.nlm.nih.gov/pubmed/17074080>

BACKGROUND:

Five percent of the Swiss population attribute symptoms to electromagnetic fields (EMF). General practitioners (GPs) might play a key role in recognising an emerging health risk, since they are the first to observe and follow up persons who attribute symptoms to EMF. It is unclear to what extent EMFs have become an issue in general practice and which experiences GPs report from the consultations.

METHODS:

We conducted telephone interviews in a random sample of GPs in Switzerland in order to assess the frequency of consultations in primary care due to EMF and the GPs' experience with these patients.

RESULTS:

342 general practitioners were interviewed, corresponding to a response rate of 28.2%. 69% of the GPs reported at least one consultation due to EMF, but GPs with a certificate in complementary medicine were much more likely to report EMF consultations. The median of EMF consultation numbers within one year was three. An overview of the most recent EMF-related consultation per GP yielded sleep disorders, headaches and fatigue as the most often reported symptoms and mobile phone base stations, power lines and the own use of mobile phones as the main EMF sources suspected to be associated to symptoms. GPs judged the association between EMF and the symptoms to be plausible in 54% of the cases. There was no combination of symptoms and EMF sources that was remarkably and consistently judged to be a plausible cause of the symptoms.

CONCLUSION:

In our survey, **GPs often judged the association between the health problems and the suspected exposure to be plausible.** This plausibility assessment seems to be based on grounds of preventive positions in a situation of scientific uncertainty. More research effort is needed to obtain more insight on a potential association between long term EMF exposure and unspecific symptoms.

134 **Irish Doctors Environmental Association (IDEA)**

<http://ideaireland.org/library/idea-position-on-electro-magnetic-radiation/>

1. An increasing number of people in Ireland are complaining of symptoms which, while they may vary in nature, intensity and duration, can be demonstrated to be clearly related to exposure to electro-magnetic radiation (EMR).

The Irish Doctors' Environmental Association believes that the Irish Government should urgently review the information currently available internationally on the topic of the thermal and non-thermal effects of exposure to electro-magnetic radiation with a view to immediately initiating appropriate research into the adverse health effects of exposure to all forms of non-ionising radiation in this country, and into the forms of treatment available elsewhere. Before the results of this research are available, an epidemiological database should be initiated of individuals suffering from symptoms thought to be related to exposure to non-ionising radiation. Those claiming to be suffering from the effects of exposure to electro-magnetic radiation should have their claims investigated in a sensitive and thorough way, and appropriate treatment provided by the State.

The strictest possible safety regulations should be established for the installation of masts and transmitters, and for the acceptable levels of potential exposure of individuals to electro-magnetic radiation.

135 **Parliamentary Assembly of the Council of Europe, Resolution 1815 (2011) (Doc 12608)**

B. Explanatory memorandum by Mr Huss, rapporteur

<http://assembly.coe.int/ASP/Doc/XrefViewPDF.asp?FileID=13137&Language=EN> (Draft resolution)

60. Here, too, the rapporteur stresses that some people may be more sensitive than others to electromagnetic radiation or waves. **The research performed, for instance, by Professor Dominique Belpomme, President of the Association for Research on Treatments Against Cancer (ARTAC), on more than 200 people describing themselves as "electrosensitive" succeeded, with corroborative results of clinical and biological analyses, in proving that there was such a syndrome of intolerance to electromagnetic fields across the whole spectrum of frequencies.** According to these results, not only proximity to the sources of electromagnetic emissions was influential, but also the time of exposure and often concomitant exposure to chemicals or to (heavy) metals present in human

tissues. In this context, Sweden has granted sufferers from electromagnetic hypersensitivity the status of persons with reduced capacity so that they receive suitable protection.

RECOGNISED BY WORLD HEALTH ORGANISATION (WHO):

See also: [Proceedings International Workshop on EMF Hypersensitivity 2004¹¹³](#).

136 World Health Organisation (WHO) Fact Sheet, Backgrounder Dec 2005

Electromagnetic fields and public health: Electromagnetic hypersensitivity

<http://www.who.int/peh-emf/publications/facts/fs296/en/>

As societies industrialize and the technological revolution continues, there has been an unprecedented increase in the number and diversity of electromagnetic field (EMF) sources. These sources include video display units (VDUs) associated with computers, mobile phones and their base stations. While these devices have made our life richer, safer and easier, they have been accompanied by concerns about possible health risks due to their EMF emissions. For some time a number of individuals have reported a variety of health problems that they relate to exposure to EMF. While some individuals report mild symptoms and react by avoiding the fields as best they can, others are so severely affected that they cease work and change their entire lifestyle. This reputed sensitivity to EMF has been generally termed "electromagnetic hypersensitivity" or EHS.

Conclusions

The symptoms are certainly real and can vary widely in their severity. Whatever its cause, **EHS can be a disabling problem for the affected individual.**

Researchers: Some **studies suggest that certain physiological responses of EHS individuals tend to be outside the normal range. In particular, hyper reactivity in the central nervous system and imbalance in the autonomic nervous system need to be followed up in clinical investigations and the results for the individuals taken as input for possible treatment.**

NOCEBO EFFECT – PSYCHOLOGICAL THERAPIES AND RISK PERCEPTION:

See also: [Levallois 2002¹⁷](#).

137 Rubin et al, 2010, Bioelectromagnetics. 2010 Jan;31(1):1-11.

Idiopathic environmental intolerance attributed to electromagnetic fields (formerly 'electromagnetic hypersensitivity'): An updated systematic review of provocation studies.

<http://www.ncbi.nlm.nih.gov/pubmed/19681059>

Idiopathic Environmental Intolerance attributed to electromagnetic fields (IEI-EMF; formerly 'electromagnetic hypersensitivity') is a medically unexplained illness in which subjective symptoms are reported following exposure to electrical devices. In an earlier systematic review, we reported data from 31 blind provocation studies which had exposed IEI-EMF volunteers to active or sham electromagnetic fields and assessed whether volunteers could detect these fields or whether they reported worse symptoms when exposed to them. In this article, we report an update to that review. An extensive literature search identified 15 new experiments. Including studies reported in our earlier review, 46 blind or double-blind provocation studies in all, involving 1175 IEI-EMF volunteers, have tested whether exposure to electromagnetic fields is responsible for triggering symptoms in IEI-EMF. No robust evidence could be found to support this theory. However, the studies included in the review did support the role of the nocebo effect in triggering acute symptoms in IEI-EMF sufferers. Despite the conviction of IEI-EMF sufferers that their symptoms are triggered by exposure to electromagnetic fields, repeated experiments have been unable to replicate this phenomenon under controlled conditions. A narrow focus by clinicians or policy makers on bioelectromagnetic mechanisms is therefore, unlikely to help IEI-EMF patients in the long-term.

138 Hagström et al, 2013, Pathophysiology. 2013 Apr;20(2):117-22.

Electromagnetic hypersensitive Finns: Symptoms, perceived sources and treatments, a questionnaire study.

<http://www.ncbi.nlm.nih.gov/pubmed/23557856>

According to 76% of 157 respondents the reduction or avoidance of electromagnetic fields (EMF) helped in their full or partial recovery. The best treatments for EHS were given as: "dietary change" (69.4%), "nutritional supplements" (67.8%) and "increased physical exercise" (61.6%). **The official treatment recommendations of psychotherapy (2.6%) and medication (-4.2%) were not significantly helpful.** According to the present results the official treatment protocols

should take better account the EHS person's own experiences. **The avoidance of electromagnetic radiation and fields effectively removed or lessened the symptoms in EHS persons.**

PAPERS REFUTING THE NOCEBO EFFECT
DEMONSTRATING EHS TYPE EFFECTS IN CHILDREN & FOETUSES:

139 Bioinitiative report 2012

<http://www.bioinitiative.org/>

Conclusions: FETAL AND NEONATAL EFFECTS OF EMF

Fetal (in-utero) and early childhood exposures to cell phone radiation and wireless technologies in general may be a risk factor for hyperactivity, learning disorders and behavioral problems in school.

Effects on the developing fetus from in-utero exposure to cell phone radiation have been observed in both human and animal studies since 2006. Sources of fetal and neonatal exposures of concern include cell phone radiation (both paternal use of wireless devices worn on the body and maternal use of wireless phones during pregnancy). Exposure to whole-body RFR from base stations and WI-FI, use of wireless laptops, use of incubators for newborns with excessively high ELF-EMF levels.

140 Divan et al, 2012, J Epidemiol Community Health 2012;66:524-529

Cell phone use and behavioural problems in young children

<http://jech.bmj.com/content/66/6/524.short>

Background: Potential health effects of cell phone use in children have not been adequately examined. As children are using cell phones at earlier ages, research among this group has been identified as the highest priority by both national and international organisations. The authors previously reported results from the Danish National Birth Cohort (DNBC), which looked at prenatal and postnatal exposure to cell phone use and behavioural problems at age 7 years. **Exposure to cell phones prenatally, and to a lesser degree postnatally, was associated with more behavioural difficulties.** The original analysis included nearly 13 000 children who reached age 7 years by November 2006.

Methods: To see if a larger, separate group of DNBC children would produce similar results after considering additional confounders, children of mothers who might better represent current users of cell phones were analysed. This 'new' dataset consisted of 28 745 children with completed Age-7 Questionnaires to December 2008.

Results: The highest OR for behavioural problems were for children who had both prenatal and postnatal exposure to cell phones compared with children not exposed during either time period. The adjusted effect estimate was 1.5 (95% CI 1.4 to 1.7).

Conclusions: The findings of the previous publication were replicated in this separate group of participants demonstrating that **cell phone use was associated with behavioural problems at age 7 years in children, and this association was not limited to early users of the technology.** Although weaker in the new dataset, even with further control for an extended set of potential confounders, the associations remained.

[Exposure: prenatal and postnatal]

141 Divan, H. et al, 2008, Epidemiology 19 523-529, 2008

Prenatal and postnatal exposure to cell phone use and behavioral problems in children.

<http://www.ncbi.nlm.nih.gov/pubmed/18467962>

Exposure to cell phones prenatally and, to a lesser degree, postnatally was associated with behavioral difficulties such as emotional and hyperactivity problems around the age of school entry. These associations may be noncausal and may be due to unmeasured confounding. If real, they would be of **public health concern given the widespread use of this technology.**

142 Rezk et al, 2008, Saudi Med J. 2008 Feb;29(2):218-23.

Fetal and neonatal responses following maternal exposure to mobile phones.

<http://www.ncbi.nlm.nih.gov/pubmed/18246230>

OBJECTIVE:

To study fetal and neonatal heart rate (HR) and cardiac output (COP), following acute maternal exposure to electromagnetic fields (EMF) emitted by mobile phones.

METHODS:

The present study was carried out at Benha University Hospital and El-Shorouq Hospital, Cairo, Egypt, from October 2003 to March 2004. Ninety women with uncomplicated pregnancies aged 18-33 years, and 30 full term healthy newborn infants were included. The pregnant mothers were exposed to EMF emitted by mobile telephones while on

telephone-dialing mode for 10 minutes during pregnancy and after birth. The main outcome were measurements of fetal and neonatal HR and COP.

RESULTS:

A statistical significant increase in fetal and neonatal HR, and statistical significant decrease in stroke volume and COP before and after use of mobile phone were noted. All these changes are attenuated with increase in gestational age.

CONCLUSION:

Exposure of pregnant women to mobile phones significantly increase fetal and neonatal HR, and significantly decreased the COP.

[Exposure: 900 MHz (pulsed); 10 min/day during pregnancy and 48h after birth]

143 Sudan et al, 2012, Open Pediatr Med Journal. 2012 Dec 5;6(2012):46-52.

Prenatal and Postnatal Cell Phone Exposures and Headaches in Children.

<http://www.ncbi.nlm.nih.gov/pubmed/23750182>

The Danish National Birth Cohort enrolled pregnant women between 1996 and 2002. When their children reached age seven years, mothers completed a questionnaire regarding the child's health, behaviors, and exposures. We used multivariable adjusted models to relate prenatal only, postnatal only, or both prenatal and postnatal cell phone exposure to whether the child had migraines and headache-related symptoms.

Results: Our analyses included data from 52,680 children. Children with cell phone exposure had higher odds of migraines and headache-related symptoms than children with no exposure. The odds ratio for migraines was 1.30 (95% confidence interval: 1.01-1.68) and for headache-related symptoms was 1.32 (95% confidence interval: 1.23-1.40) for children with both prenatal and postnatal exposure.

Conclusions: **In this study, cell phone exposures were associated with headaches in children, but the associations may not be causal given the potential for uncontrolled confounding and misclassification in observational studies such as this. However, given the widespread use of cell phones, if a causal effect exists it would have great public health impact.**

PAPERS REFUTING THE NOCEBO EFFECT **DEMONSTRATING EHS TYPE EFFECTS IN ANIMALS:**

144 Aldad T. S. et al, Mar 2012, Scientific Reports, Nature, 5 Mar 2012

Fetal Radiofrequency Radiation Exposure From 800-1900 Mhz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice

<http://www.nature.com/srep/2012/120315/srep00312/full/srep00312.html>

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3575011/pdf/srep01320.pdf> [Erratum does not affect conclusion]

Mice exposed in-utero were hyperactive and had impaired memory as determined using the object recognition, light/dark box and step-down assays. Whole cell patch clamp recordings of miniature excitatory postsynaptic currents (mEPSCs) revealed that **these behavioral changes were due to altered neuronal developmental programming.** Exposed mice had dose-responsive impaired glutamatergic synaptic transmission onto layer V pyramidal neurons of the prefrontal cortex. **We present the first experimental evidence of neuropathology due to in-utero cellular telephone radiation.** Further experiments are needed in humans or non-human primates to determine the risk of exposure during pregnancy.

[Exposure: mobile phone 800-1900 MHz, continuous for 0, 9, 15 or 24 h/day on day 1-17 of gestation; SAR 1.6 W/kg]

145 Balmori et al, 2010, Electromagn Biol Med. 2010 Jun;29(1-2):31-5..

Mobile phone mast effects on common frog (Rana temporaria) tadpoles: the city turned into a laboratory.

<http://www.ncbi.nlm.nih.gov/pubmed/20560769>

An experiment has been made exposing eggs and tadpoles of the common frog (Rana temporaria) to electromagnetic radiation from several mobile (cell) phone antennae located at a distance of 140 meters. The experiment lasted two months, from the egg phase until an advanced phase of tadpole prior to metamorphosis. Measurements of electric field intensity (radiofrequencies and microwaves) in V/m obtained with three different devices were 1.8 to 3.5 V/m. In the exposed group (n = 70), **low coordination of movements**, an asynchronous growth, resulting in both big and small tadpoles, and a high mortality (90%) was observed. Regarding the control group (n = 70) under the same conditions but inside a Faraday cage, the coordination of movements was normal, the development was synchronous, and a mortality of 4.2% was obtained. **These results indicate that radiation emitted by phone masts in a real situation may affect the**

development and may cause an increase in mortality of exposed tadpoles. This research may have huge implications for the natural world, which is now exposed to high microwave radiation levels from a multitude of phone masts.

[Exposure: 648-2155 MHz; continuous for 2 months (from egg to prior to metamorphosis); electric field strength 1.8-3.5 V/m]

146 Balmori et al, 2007, Electromagn Biol Med. 2007;26(2):141-51.

The urban decline of the house sparrow (*Passer domesticus*): a possible link with electromagnetic radiation.

<http://www.ncbi.nlm.nih.gov/pubmed/17613041>

During recent decades, there has been a marked decline of the house sparrow (*Passer domesticus*) population in the United Kingdom and in several western European countries. The aims of this study were to determine whether the population is also declining in Spain and to evaluate the hypothesis that electromagnetic radiation (microwaves) from phone antennae is correlated with the decline in the sparrow population. Between October 2002 and May 2006, point transect sampling was performed at 30 points during 40 visits to Valladolid, Spain. At each point, we carried out counts of sparrows and measured the mean electric field strength (radiofrequencies and microwaves: 1 MHz-3 GHz range). Significant declines ($P = 0.0037$) were observed in the mean bird density over time, and **significantly low bird density was observed in areas with high electric field strength**. The logarithmic regression of the mean bird density vs. field strength groups (considering field strength in 0.1 V/m increments) was $R = -0.87$ ($P = 0.0001$). **The results of this article support the hypothesis that electromagnetic signals are associated with the observed decline in the sparrow population. We conclude that electromagnetic pollution may be responsible, either by itself or in combination with other factors, for the observed decline of the species in European cities during recent years. The apparently strong dependence between bird density and field strength according to this work could be used for a more controlled study to test the hypothesis.**

[Exposure: 1-3 GHz; 3 years and 8 months; electric field strength 0.4-3.5 V/m]

147 Cammaerts et al, 2013, Electromagn Biol Med. 2013 Aug 26.

Ants can be used as bio-indicators to reveal biological effects of electromagnetic waves from some wireless apparatus.

<http://www.ncbi.nlm.nih.gov/pubmed/23977878>

Society is confronted with an increasing number of applications making use of wireless communication. We also notice an increasing awareness about potentially harmful effects of the related electromagnetic fields on living organisms. At present, it is not realistic to expect that wireless communication will decrease or disappear within the near future. That is why we currently are investigating the mechanisms behind these effects and the effectiveness of possible solutions. In order to be efficient and effective, we designed and validated a fast and easy test on ants - **these insects being used as a biological model - for revealing the effect of wireless equipments like mobile phones, smartphones, digital enhanced cordless telephone (DECT) phones, WiFi routers and so on. This test includes quantification of ants' locomotion under natural conditions, then in the vicinity of such wireless equipments. Observations, numerical results and statistical results allow detecting any effect of a radiating source on these living organisms.**

Discussion:

(2) It appeared that ants' linear and angular speeds of movement are immediately altered by the presence of electromagnetic waves.

(3) All radiating sources tested in this study on the ants demonstrated clear and statistically significant effects. It was already known that a mobile phone in standby mode affects living organisms (e.g. see Cammaerts et al., 2011; Favre, 2011; Panagopoulos et al., 2004; Sharma and Kumar, 2010). In this study, we showed that a common mobile phone has an effect while in standby mode and even in off-condition. Of course, when activated, the effect of a mobile phone is stronger. Without its battery, such a phone has no longer an effect. Our ants demonstrated that a modern smartphone and even more so a DECT phone do affect living organisms. Furthermore, the electromagnetic waves generated by a WiFi router impact our ants and such an effect increases during the course of the exposure time. Persons working in rooms provided with wireless equipment should note this result.

[Exposure: 900MHz mobile phone, smartphone, DECT phone, 2.45 GHz Wi-Fi router, notebook with Wi-Fi on]

148 Deshmukh et al, 2013, Indian J Biochem Biophys. 2013 Apr;50(2):114-9.

Effect of low level microwave radiation exposure on cognitive function and oxidative stress in rats.

<http://www.ncbi.nlm.nih.gov/pubmed/23720885?dopt=Abstract>

Use of wireless communicating devices is increasing at an exponential rate in present time and is raising serious concerns about possible adverse effects of microwave (MW) radiation emitted from these devices on human health. The present study aimed to evaluate the effects of 900 MHz MW radiation exposure on cognitive function and oxidative stress in blood of Fischer rats. Animals were divided into two groups (6 animals/group): Group I (MW-

exposed) and Group II (Sham-exposed). Animals were subjected to MW exposure (Frequency 900 MHz; specific absorption rate 8.4738×10^{-5} W/kg) in Gigahertz transverse electromagnetic cell (GTEM) for 30 days (2 h/day, 5 days/week). Subsequently, cognitive function and oxidative stress parameters were examined for each group. **Results showed significant impairment in cognitive function and increase in oxidative stress, as evidenced by the increase in levels of MDA (a marker of lipid peroxidation) and protein carbonyl (a marker of protein oxidation) and unaltered GSH content in blood. Thus, the study demonstrated that low level MW radiation had significant effect on cognitive function and was also capable of leading to oxidative stress.**

[Exposure: 900 MHz; 2h/day, 5 days/week for 30 days; SAR 84.738 μ W/kg mean value]

149 Everaert and Bauwens, 2007, Electromagn Biol Med. 2007;26(1):63-72.

A possible effect of electromagnetic radiation from mobile phone base stations on the number of breeding house sparrows (*Passer domesticus*).

<http://www.ncbi.nlm.nih.gov/pubmed/17454083>

A possible effect of long-term exposure to low-intensity electromagnetic radiation from mobile phone (GSM) base stations on the number of House Sparrows during the breeding season was studied in six residential districts in Belgium. We sampled 150 point locations within the 6 areas to examine small-scale geographic variation in the number of House Sparrow males and the strength of electromagnetic radiation from base stations. **Spatial variation in the number of House Sparrow males was negatively and highly significantly related to the strength of electric fields from both the 900 and 1800 MHz downlink frequency bands and from the sum of these bands (Chi(2)-tests and AIC-criteria, $P < 0.001$). This negative relationship was highly similar within each of the six study areas, despite differences among areas in both the number of birds and radiation levels. Thus, our data show that fewer House Sparrow males were seen at locations with relatively high electric field strength values of GSM base stations and therefore support the notion that long-term exposure to higher levels of radiation negatively affects the abundance or behavior of House Sparrows in the wild.**

[Exposure: 925-960 MHz and 1805-1880 MHz; during breeding period; range of electric field strength from 0.04 to 0.245 V/m]

150 Fragopoulou A.F. et al., 2009, Pathophysiology, 17, pp. 179-187.

Whole body exposure with GSM 900 MHz affects spatial memory in mice

<http://www.ncbi.nlm.nih.gov/pubmed/19954937>

Extended work has been performed worldwide on the effects of mobile phone radiation upon rats' cognitive functions, however there is great controversy to the existence or not of deficits. The present work has been designed in order to test the effects of mobile phone radiation on spatial learning and memory in mice *Mus musculus* Balb/c using the Morris water maze (a hippocampal-dependent spatial memory task), since there is just one other study on mice with very low SAR level (0.05W/kg) showing no effects. We have applied a 2h daily dose of pulsed GSM 900MHz radiation from commercially available mobile phone for 4 days at SAR values ranging from 0.41 to 0.98W/kg. **Statistical analysis revealed that during learning, exposed animals showed a deficit in transferring the acquired spatial information across training days (increased escape latency and distance swam, compared to the sham-exposed animals, on the first trial of training days 2-4). Moreover, during the memory probe-trial sham-exposed animals showed the expected preference for the target quadrant, while the exposed animals showed no preference, indicating that the exposed mice had deficits in consolidation and/or retrieval of the learned spatial information.** Our results provide a basis for more thorough investigations considering reports on non-thermal effects of electromagnetic fields (EMFs). [Overview given by wifiinschools: <http://wifiinschools.org.uk/6.html> found that exposure for approximately 2 hours /day to a mobile phone (0.9GHz GSM modulated mobile phone; 23-36V/m, 0.41-0.98W/Kg whole body exposure) for four days resulted in cognitive deficits in the Morris water maze, a test of spatial learning and memory. Exposed mice were less able to transfer learned information to the next day, and had deficits in consolidation and/or retrieval of the learned information.]

[Exposure: 900 MHz (pulsed); 1 h 55 min. for the first 3 days (1 h prior to the first trial, 3 x 15 min. between trials, 10 min. after the last trial); 3 hr 45 min. on the fourth days (1 h prior to the first trial, 3 x 15 min. between trials, 2 h prior to the probe trial; SAR 0.41-0.98 W/kg whole body)]

151 Khadrawy et al, 2009, Rom. J. Biophys. 2009 19(4):295-305

Effect of Electromagnetic Radiation from mobile phone on the levels of cortical amino acid neurotransmitters in adult and young rats

<http://www.biophysicsnet.ro/rjb/articles/260/yakha.pdf> (full article)

The present study aims to investigate the effect of electromagnetic radiation (EMR) generated by mobile phones on the levels of amino acid neurotransmitters; glutamate, aspartate, GABA, glycine and taurine in the cortex of adult and

young rats. Several studies showed that EMR could influence normal brain physiology, probably by changing cortical excitability. In the present study, adult and young rats were exposed to EMR for one hour/day. Amino acids were measured after 1 hour, 1, 2 and 4 months of daily EMR exposure and after 1 month of stopping exposure that extended daily for 4 months. **The present data showed that in adult rats EMR induced significant changes in the cortical levels of some studied amino acids throughout the exposure periods. However, in young rats EMR induced significant changes after 4 months of daily exposure and after stopping exposure. It could be suggested that the changes in amino acid neurotransmitters may underlie the EMR-induced changes in cortical excitability.**

[Exposure: 900 MHz; continuous for 1 h/day for up to 4 months; SAR 1.165 W/kg average mass (partial body/rat's head)]

152 Maaroufi et al, 2014, Behav Brain Res. 2014 Jan 1;258:80-9.

Spatial learning, monoamines and oxidative stress in rats exposed to 900 MHz electromagnetic field in combination with iron overload.

<http://www.ncbi.nlm.nih.gov/pubmed/24144546>

The increasing use of mobile phone technology over the last decade raises concerns about the impact of high frequency electromagnetic fields (EMF) on health. More recently, a link between EMF, iron overload in the brain and neurodegenerative disorders including Parkinson's and Alzheimer's diseases has been suggested. Co-exposure to EMF and brain iron overload may have a greater impact on brain tissues and cognitive processes than each treatment by itself. To examine this hypothesis, Long-Evans rats submitted to 900 MHz exposure or combined 900 MHz EMF and iron overload treatments were tested in various spatial learning tasks (navigation task in the Morris water maze, working memory task in the radial-arm maze, and object exploration task involving spatial and non spatial processing). Biogenic monoamines and metabolites (dopamine, serotonin) and oxidative stress were measured. **Rats exposed to EMF were impaired in the object exploration task but not in the navigation and working memory tasks. They also showed alterations of monoamine content in several brain areas but mainly in the hippocampus.** Rats that received combined treatment did not show greater behavioral and neurochemical deficits than EMF-exposed rats. None of the two treatments produced global oxidative stress. **These results show that there is an impact of EMF on the brain and cognitive processes** but this impact is revealed only in a task exploiting spontaneous exploratory activity. In contrast, there are no synergistic effects between EMF and a high content of iron in the brain.

[Exposure: 900 MHz; 1 h/day for 21 consecutive days; SAR 0.05-0.18 W/kg]

153 Margaritis et al, 2013, Electromagn Biol Med. 2013 Aug 5.

Drosophila oogenesis as a bio-marker responding to EMF sources (Fly)

<http://www.ncbi.nlm.nih.gov/pubmed/23915130>

The model biological organisms *Drosophila melanogaster* and *Drosophila virilis* have been utilized to assess effects on apoptotic cell death of follicles during oogenesis and reproductive capacity (fecundity) decline. A total of 280 different experiments were performed using newly emerged flies exposed for short time daily for 3-7d to **various EMF sources including: GSM 900/1800MHz mobile phone, 1880-1900MHz DECT wireless base, DECT wireless handset, mobile phone-DECT handset combination, 2.44GHz wireless network (Wi-Fi), 2.44GHz blue tooth, 92.8MHz FM generator, 27.15MHz baby monitor, 900MHz CW RF generator and microwave oven's 2.44GHz RF and magnetic field components.** Mobile phone was used as a reference exposure system for evaluating factors considered very important in dosimetry extending our published work with *D. melanogaster* to the insect *D. virilis*. Distance from the emitting source, the exposure duration and the repeatability were examined. **All EMF sources used created statistically significant effects regarding fecundity and cell death-apoptosis induction, even at very low intensity levels (0.3V/m blue tooth radiation), well below ICNIRP's guidelines, suggesting that Drosophila oogenesis system is suitable to be used as a biomarker for exploring potential EMFbioactivity.** Also, there is no linear cumulative effect when increasing the duration of exposure or using one EMF source after the other (i.e. mobile phone and DECT handset) at the specific conditions used. The role of the average versus the peak E-field values as measured by spectrum analyzers on the final effects is discussed.

[Exposure: various real device sources (see abstract)]

154 Megha et al, 2012, Indian J Exp Biol. 2012 Dec;50(12):889-96.

Microwave radiation induced oxidative stress, cognitive impairment and inflammation in brain of Fischer rats.

<http://www.ncbi.nlm.nih.gov/pubmed/23986973>

Public concerns over possible adverse effects of microwave radiation emitted by mobile phones on health are increasing. To evaluate the intensity of oxidative stress, cognitive impairment and inflammation in brain of Fischer rats exposed to microwave radiation, male Fischer-344 rats were exposed to 900 MHz microwave radiation (SAR = 5.953 x 10⁻⁴ W/kg) and 1800 MHz microwave radiation (SAR = 5.835 x 10⁻⁴ W/kg) for 30 days (2 h/day). **Significant**

impairment in cognitive function and induction of oxidative stress in brain tissues of microwave exposed rats were observed in comparison with sham exposed groups. Further, significant increase in level of cytokines (IL-6 and TNF-alpha) was also observed following microwave exposure. Results of the present study indicated that increased oxidative stress due to microwave exposure may contribute to cognitive impairment and inflammation in brain.
[Exposure: 900/1800 MHz; 2 h/day, 5 days/week for 30 days; SAR 0.5953 and 0.5835 MW/kg]

155 Narayan et al, 2014, Bratisl Lek Listy. 2014;115(5):260-6.

Evaluation of oxidant stress and antioxidant defense in discrete brain regions of rats exposed to 900 MHz radiation.

<http://www.ncbi.nlm.nih.gov/pubmed/25174055>

http://www.elis.sk/download_file.php?product_id=3853&session_id=deqm9crfh6sl8r7oiqtl80khc0 (full paper)

In the current study, the effects of 900 MHz radio-frequency electromagnetic radiation (RF-EMR) on levels of thiobarbituric acid-reactive substances (TBARS), total antioxidants (TA), and glutathione S-transferase (GST) activity in discrete brain regions were studied in adolescent rats.

MATERIALS AND METHODS:

Thirty-six male Wistar rats (6-8 weeks old) were allotted into three groups (n = 12 in each group). Control group (1) remained undisturbed in their home cage; sham group (2) was exposed to mobile phone in switch off mode for four weeks; RF-EMR-exposed group (3) was exposed to 900 MHz of RF-EMR (1 hr/day with peak power density of 146.60 $\mu\text{W}/\text{cm}^2$) from an activated Global System for Mobile communication (GSM) mobile phone (kept in silent mode; no ring tone and no vibration) for four weeks. On 29th day, behavioral analysis was done. Followed by this, six animals from each group were sacrificed and biochemical parameters were studied in amygdala, hippocampus, frontal cortex, and cerebellum.

RESULTS:

Altered behavioral performances were found in RF-EMR-exposed rats. Additionally, elevated TBARS level was found with all brain regions studied. RF-EMR exposure significantly decreased TA in the amygdala and cerebellum but its level was not significantly changed in other brain regions. **GST activity was significantly decreased in the hippocampus** but, its activity was unaltered in other brain regions studied.

CONCLUSION:

RF-EMR exposure for a month induced oxidative stress in rat brain, but its magnitude was different in different regions studied. RF-EMR-induced oxidative stress could be one of the underlying causes for the behavioral deficits seen in rats after RF-EMR exposure (Fig. 5, Ref. 37).

[Exposure: mobile phone 890=915 MHz; continuous for 1 h/day for 28 days (in silent mode, no ring tone and vibration); SAR 1.58 W/kg (according to manufacturer)]

156 Narayanan et al, 2013, Neurol Sci. 2013 Jul;34(7):1117-24.

Analysis of emotionality and locomotion in radio-frequency electromagnetic radiation exposed rats.

<http://www.ncbi.nlm.nih.gov/pubmed/22976773>

In the current study the modulatory role of mobile phone radio-frequency electromagnetic radiation (RF-EMR) on emotionality and locomotion was evaluated in adolescent rats. Male albino Wistar rats (6-8 weeks old) were randomly assigned into the following groups having 12 animals in each group. Group I (Control): they remained in the home cage throughout the experimental period. Group II (Sham exposed): they were exposed to mobile phone in switch-off mode for 28 days, and Group III (RF-EMR exposed): they were exposed to RF-EMR (900 MHz) from an active GSM (Global system for mobile communications) mobile phone with a peak power density of 146.60 $\mu\text{W}/\text{cm}^2$ for 28 days. On 29th day, the animals were tested for emotionality and locomotion. **Elevated plus maze (EPM) test revealed that, percentage of entries into the open arm, percentage of time spent on the open arm and distance travelled on the open arm were significantly reduced in the RF-EMR exposed rats. Rearing frequency and grooming frequency were also decreased in the RF-EMR exposed rats. Defecation boli count during the EPM test was more with the RF-EMR group.** No statistically significant difference was found in total distance travelled, total arm entries, percentage of closed arm entries and parallelism index in the RF-EMR exposed rats compared to controls. **Results indicate that mobile phone radiation could affect the emotionality of rats without affecting the general locomotion.**

[Exposure: mobile phone 900 MHz; continuous for 1h/day for 28 days (activated giving missed or unattended calls, 20 calls/h, phone allowed to ring for 45 s followed by a 15 s interval before the next call); peak power density 146.60 $\mu\text{W}/\text{cm}^2$, SAR 1.15 W/kg]

157 Narayanan et al, 2010, Ups J Med Sci. 2010 May;115(2):91-6.

Effect of radio-frequency electromagnetic radiations (RF-EMR) on passive avoidance behaviour and hippocampal morphology in Wistar rats.

<http://www.ncbi.nlm.nih.gov/pubmed/20095879>

INTRODUCTION:

The interaction of mobile phone radio-frequency electromagnetic radiation (RF-EMR) with the brain is a serious concern of our society.

OBJECTIVE:

We evaluated the effect of RF-EMR from mobile phones on passive avoidance behaviour and hippocampal morphology in rats.

MATERIALS AND METHODS:

Healthy male albino Wistar rats were exposed to RF-EMR by giving 50 missed calls (within 1 hour) per day for 4 weeks, keeping a GSM (0.9 GHz/1.8 GHz) mobile phone in vibratory mode (no ring tone) in the cage. After the experimental period, passive avoidance behaviour and hippocampal morphology were studied.

RESULTS:

Passive avoidance behaviour was significantly affected in mobile phone RF-EMR-exposed rats demonstrated as shorter entrance latency to the dark compartment when compared to the control rats. Marked morphological changes were also observed in the CA(3) region of the hippocampus of the mobile phone-exposed rats in comparison to the control rats.

CONCLUSION:

Mobile phone RF-EMR exposure significantly altered the passive avoidance behaviour and hippocampal morphology in rats.

[Exposure: mobile phone 900MHz/1.8GHz; 50 times 45s/h once per day for 4 weeks]

158 Nittby et al, 2008, Bioelectromagnetics. 2008 Apr;29(3):219-32.

Cognitive impairment in rats after long-term exposure to GSM-900 mobile phone radiation.

<http://www.ncbi.nlm.nih.gov/pubmed/18044737>

Considering the frequent use of mobile phones, we have directed attention to possible implications on cognitive functions. In this study we investigated in a rat model the long-term effects of protracted exposure to Global System for Mobile Communication-900 MHz (GSM-900) radiation. Out of a total of 56 rats, 32 were exposed for 2 h each week for 55 weeks to radio-frequency electromagnetic radiation at different SAR levels (0.6 and 60 mW/kg at the initiation of the experimental period) emitted by a (GSM-900) test phone. Sixteen animals were sham exposed and eight animals were cage controls, which never left the animal house. After this protracted exposure, GSM-900 exposed rats were compared to sham exposed controls. Effects on exploratory behaviour were evaluated in the open-field test, in which no difference was seen. Effects on cognitive functions were evaluated in the episodic-like memory test. **In our study, GSM exposed rats had impaired memory for objects and their temporal order of presentation, compared to sham exposed controls** (P = 0.02). Detecting the place in which an object was presented was not affected by GSM exposure.

Our results suggest significantly reduced memory functions in rats after GSM microwave exposure (P = 0.02).

[Exposure: 900 MHz (pulsed); 2 h/week for 55 weeks; SAR 0.6 mW/kg (at 33 mW/m²) and 60 mW/kg (at 3.3 W/m²) average over mass (whole body)]

159 Ntzouni et al, 2013, Electromagn Biol Med. 2013 Mar;32(1):95-120.

Transient and cumulative memory impairments induced by GSM 1.8 GHz cell phone signal in a mouse model.

<http://www.ncbi.nlm.nih.gov/pubmed/23320614>

This study was designed to investigate the transient and cumulative impairments in spatial and non-spatial memory of C57Bl/6J mice exposed to GSM 1.8 GHz signal for 90 min daily by a typical cellular (mobile) phone at a specific absorption rate value of 0.11 W/kg. Free-moving male mice 2 months old were irradiated in two experimental protocols, lasting for 66 and for 148 days respectively. Each protocol used three groups of animals (n = 8 each for exposed, sham exposed and controls) in combination with two behavioural paradigms, the object recognition task and the object location task sequentially applied at different time points. One-way analysis of variance **revealed statistically significant impairments of both types of memory gradually accumulating, with more pronounced effects on the spatial memory. The impairments persisted even 2 weeks after interruption of the 8 weeks daily exposure**, whereas the memory of mice as detected by both tasks showed a full recovery approximately 1 month later. Intermittent every other day exposure for 1 month had no effect on both types of memory. **The data suggest that visual information processing mechanisms in hippocampus, perirhinal and entorhinal cortex are gradually malfunctioning upon long-term daily exposure, a phenotype that persists for at least 2 weeks after interruption of radiation, returning to normal memory performance levels 4 weeks later.** It is postulated that cellular repair mechanisms are operating to eliminate the memory affecting molecules. The overall contribution of several possible mechanisms to the observed cumulative and transient impairments in spatial and non-spatial memory is discussed.

[Exposure: mobile phone (speaking mode) 1800 MHz; 90 min/day or every second day for up to 83 days; SAR 0.11 W/kg effective value]

160 Ntzouni et al, 2011, Pathophysiology. 2011 Jun;18(3):193-9.

Short-term memory in mice is affected by mobile phone radiation.

<http://www.ncbi.nlm.nih.gov/pubmed/21112192>

The effects of mobile phone electromagnetic fields (EMFs) were studied on a non-spatial memory task (Object Recognition Task - ORT) that requires entorhinal cortex function. The task was applied to three groups of mice *Mus musculus* C57BL/6 (exposed, sham-exposed and control) combined with 3 different radiation exposure protocols. In the first protocol designated "acute exposure", mice 45 days old (PND45 - postnatal day 45) were exposed to mobile phone (MP) radiation (SAR value 0.22W/kg) during the habituation, the training and the test sessions of the ORT, but not during the 10min inter-trial interval (ITI) where consolidation of stored object information takes place. On the second protocol designated "chronic exposure-I", the same mice were exposed for 17 days for 90min/per day starting at PND55 to the same MP radiation. ORT recognition memory was performed at PND72 with radiation present only during the ITI phase. In the third protocol designated "chronic exposure-II", mice continued to be exposed daily under the same conditions up to PND86 having received radiation for 31 days. One day later the ORT test was performed without irradiation present in any of the sessions. **The ORT-derived discrimination indices in all three exposure protocols revealed a major effect on the "chronic exposure-I" suggesting a possible severe interaction of EMF with the consolidation phase of recognition memory processes. This may imply that the primary EMF target may be the information transfer pathway connecting the entorhinal-parahippocampal regions which participate in the ORT memory task.**

[Exposure:mobile phone 1800 MHz; 90 min/day for 3 days, 17 days or 31 days; SAR 0.22 W/kg average over mass (brain)]

161 Sarapultseva et al, 2013, Int J Radiat Biol. 2013 Nov 25.

The in-vivo effects of low-intensity radiofrequency fields on the motor activity of protozoa

<http://www.ncbi.nlm.nih.gov/pubmed/24266430>

Purpose: To analyze the direct and transgenerational effects of exposure to low-dose 1 GHz (mobile phone/wireless telecommunication range) and 10 GHz (radar/satellite communication range) radiofrequency electromagnetic fields (RF-EMF) on the motility of ciliates *Spirostomum ambiguum*.

Materials and Methods: *S. ambiguum* were exposed to 1 GHz and 10 GHz RF-EMF with power flux densities (PD) ranging from 0.05 to 0.5 W/m² over a period of time from 0.05 to 10 h. The motility of directly exposed ciliates and their non-exposed progeny across 10-15 generations was measured.

Results: **Exposure to 0.1 W/m² of either 1 or 10 GHz RF-EMF resulted in a significant decrease in the motility. The dose of exposure capable of altering the mobility of ciliates was inversely correlated with the flux density of RF-EMF. The motility of the non-exposed progeny of ciliates irradiated with 0.1 W/m² of 10 GHz RF-EMF remained significantly compromised, at least, across 10-15 generations, thus indicating the presence of transgenerational effects.**

Conclusions: **The results of our study show that low-dose exposure to RF-EMF can significantly affect the motility of irradiated ciliates and their non-exposed offspring, thus providing further insights into the unknown mechanisms underlying the in vivo effects of RF-EMF.**

[Exposure: 1GHz and 10GHz; 0.05-10h; 0.05-0.5W/m²]

162 Sinha RK, 2008, Int J Radiat Biol, 84(6):505-513, 2008

Chronic non-thermal exposure of modulated 2450 MHz microwave radiation alters thyroid hormones and behavior of male rats.

<http://www.ncbi.nlm.nih.gov/pubmed/18470749>

The purpose of this investigation was to analyze the effects of leakage microwave (2450 MHz) irradiation on thyroid hormones and behavior of male rats.

MATERIALS AND METHODS:

Experiments were carried out on two groups of male rats (exposure and control, respectively). Radio-immuno assay (RIA) methods were used for estimation of 3,5,3'-triiodothyronine (T3), thyroxine (T4) and thyrotrophin or thyroid stimulating hormone (TSH). The assessments of behavioral changes were performed in Open-Field (OF) and Elevated Plus-Maze (EPM) apparatuses.

RESULTS:

Following chronic microwave exposure, rats were found hyperactive and aggressive on the 16th and 21st days.

Behavioral changes in OF were analyzed and found to be significantly changed from controls ($p < 0.05$) for immobilization, rearing and ambulation behavior. In EPM, rats showed increased activity with decreased time spent in the open arm and more time spent in the center on the 11th ($p < 0.05$), 16th ($p < 0.05$) and 21st day ($p < 0.01$) after

irradiation. Changes in behavioral parameters are also correlated with the trend of changes, compared to control animals, in hormonal blood levels of T3 (decreased on the 16th day, $p < 0.05$ and 21st day, $p < 0.01$) and T4 (increased on the 21st day, $p < 0.05$).

CONCLUSION:

Low energy microwave irradiation may be harmful as it is sufficient to alter the levels of thyroid hormones as well as the emotional reactivity of the irradiated compared to control animals.

[Exposure: 2450 MHz pulsed; repeated daily exposure 2 h/day for up to 21 days; SAR 0.98 and $3.6\mu\text{W/g}$ average over mass (whole body)]

163 Zhao et al, 2012, Biomedical and Environmental Sciences, 2012, 2,2,182-188

Relationship between Cognition Function and Hippocampus Structure after Long-term Microwave Exposure

<http://www.ncbi.nlm.nih.gov/pubmed/22998825>

To analyze the effects of long-term microwave exposure on hippocampal structure and function in the rat. Experiments were performed on 184 male Wistar rats (three exposure groups and a sham group). Microwaves were applied daily for 6 min over 1 month at average power densities of 2.5, 5, and 10 mW/cm². Learning and memory abilities were assessed by Morris water maze. High performance liquid chromatography was used to detect neurotransmitter concentrations in the hippocampus. Hippocampal structures were observed by histopathological analysis. **Following long-term microwave exposure there was a significant decrease in learning and memory activity in the 7 d, 14 d, and 1 m in all three microwave exposure groups.** Neurotransmitter concentrations of four amino acids (glutamate, aspartic acid, glycine, and gamma-aminobutyric acid) in hippocampus were increased in the 2.5 and 5 mW/cm² groups and decreased in the 10 mW/cm² group. **There was evidence of neuronal degeneration and enlarged perivascular spaces in the hippocampus in the microwave exposure groups. Further, mitochondria became swollen and cristae were disordered. The rough endoplasmic reticulum exhibited sacculated distension and there was a decrease in the quantity of synaptic vesicles. These data suggest that the hippocampus can be injured by long-term microwave exposure, which might result in impairment of cognitive function due to neurotransmitter disruption.**

[Exposure: unspecified frequency; continuous for 6 min/day for up to 1 month; SAR 1.05 / 2.1 / 4.2 W/kg average over time]

RECOGNISED AS A FUNCTIONAL IMPAIRMENT:

164 Johansson, 2006, Electromagn Biol Med. 2006;25(4):245-58.

Electrohypersensitivity: state-of-the-art of a functional impairment.

<http://www.ncbi.nlm.nih.gov/pubmed/17178584>

<http://www.national-toxic-encephalopathy-foundation.org/esen.pdf> (full paper)

165 Sweden

<http://www.es-uk.info/information/8-ehs-in-sweden.html>

In Sweden, electrohypersensitivity (EHS) is an officially fully recognized functional impairment (i.e., it is not regarded as a disease, thus no diagnosis* exists; N.B. This is not special for Sweden, the terms "functional impairment" and "disease" are defined according to various international documents).

166 USA, United States Access Board

<http://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/background/ada-accessibility-guidelines-for-recreation-facilities/general-issues>

"The Board recognizes that multiple chemical sensitivities and electromagnetic sensitivities may be considered disabilities under the ADA if they so severely impair the neurological, respiratory or other functions of an individual that it substantially limits one or more of the individual's major life activities. The Board plans to closely examine the needs of this population, and undertake activities that address accessibility issues for these individuals".

167 Genuis and Lipp, 2012, Sci Total Environ. 2012 Jan 1;414:103-12.

Electromagnetic hypersensitivity: fact or fiction?

<http://www.ncbi.nlm.nih.gov/pubmed/22153604>

LEGAL CASES:

168 Australia, 2013, McDonald and Comcare, 2013, AATA 105

<http://www.austlii.edu.au/au/cases/cth/aat/2013/105.html>

<http://www.news.com.au/technology/csiro-scientist-dr-david-mcdonald-wins-compensation-for-wifi-pain/story-e6frfnr-1226729178281>

Australian legal case. "The AAT ruling means he will continue to be paid **75 per cent of his salary**, as compensation for his illness."

169 France, 2014

<http://www.journaldelenvironnement.net/article/dans-l-essonne-l-electrosensibilite-reconnue-comme-un-handicap,45060> [Author's note: translated using Google Translate].

The county house of Disabled Persons (MDPH) Essonne granted late January financial assistance to a person Electro, a first in France, according to the Collective of Electro France.

Living in the south of the Essonne, Jerome, 32, had to stop work in 2011 because of an EHS (EHS) contracted at work [1]. In question according to him, a device it was, as a technician in a public laboratory chemistry research, confronted daily.

If the status of occupational disease was refused -decision taken despite the positive opinion of a medical expert, and is now challenging before justice-, Jerome had more success with the MDPH of Essonne, structure that depends on the General Council.

A pioneer in the field, this department has included in its EHS health scheme for the period 2013-2018, recognizing the de facto disability, recalls Sophie Pelletier, co-chair of the Collective of electro de France, contacted by the JDLE.

If the MDPH of Essonne has already granted several electro disabled worker status, his decision in late January to provide financial assistance to Jerome seems a first in France, at least to "knowledge" of the Collective of Electro de France, says Sophie Pelletier.

Help to develop home

Contacted by the JDLE, Jerome says that this aid has been granted to convert his home and protect personally: he was able to buy grounding hardware [2], a voice recognition system allowing it to stay away from his computer, an anti-waves canopy bed, the anti-wave tissue to cover when it comes out in the city, as well as measuring equipment -in this case the antennas for its wave detector.

Discreet on the amount of this aid, Jerome says she allows it to cover about 75% of its needs equipment. It includes one-time assistance for the most expensive equipment, and monthly assistance for those that must be renewed, especially the anti-wave which he covers his clothes and cap fabric. All allocated for a period of three years.

"What has brought us to this recognition, is the fact that this issue was supported by very credible testimony of the medical profession, leaving no doubt about the reality of the disease," equivalent to a 80 disability rate % JDLE explains to the director of the MDPH, Olivier Desmazeaud. He is to date the only application for financial assistance that the structure is treated for electro.

On sick leave since 2011, Jerome hopes to undertake training to retrain with the aim to find a job he could do at home.

[1] The name has been changed.

[2] This material is evacuated to the ground the electric charge in the surroundings.

170 Spain, 2011, Spanish Labour Court of Madrid

<http://www.portalesmedicos.com/medicina/noticias/10451/1/La-hipersensibilidad-a-las-ondas-que-producen-los-telefonos-moviles-se-convierte-en-una-nueva-causa-de-incapacidad-permanente/Page1.html>

'This has been ruled by the Labour Court to declare Madrid 24 permanent incapacitation of a college professor who suffered from chronic fatigue and environmental and electromagnetic hypersensitivity. The ruling is unique in this regard and make a precedent for future conditions related to hypersensitivity to these waves. The verdict was issued on 23 May and gave the **teachers 100% of his base salary**'.

171 UK, 2012, British Tribunal Case Won

[Author's note: text directly from claimant].

The case was heard in the Social Entitlement Chamber in July 2012. The claimant was awarded Employment and Support Allowance under ESA Regulation 29 (Exceptional Circumstances)
ESA Regulation 29 (Exceptional circumstances)

29.—(1) A claimant who does not have limited capability for work as determined in accordance with the limited capability for work assessment is to be treated as having limited capability for work if paragraph (2) applies to the claimant.

(2) This paragraph applies if—

(a) the claimant is suffering from a life threatening disease in relation to which—

(i) there is medical evidence that the disease is uncontrollable, or uncontrolled, by a recognised therapeutic procedure; and

(ii) in the case of a disease that is uncontrolled, there is a reasonable cause for it not to be controlled by a recognised therapeutic procedure; or

(b) the claimant suffers from some specific disease or bodily or mental disablement and, by reasons of such disease or disablement, there would be a substantial risk to the mental or physical health of any person if the claimant were found not to have limited capability for work.

The Judge stated that “were it not for EMR the appellant would lead a normal life with little or no functional impairment”. Further that “.....the condition described was not one commonly found but the Tribunal considered the reality of life.....Considerations included the fact that the appellant would be unable to work in any ‘normal’ working environment indoors or outside- anywhere there was Wi-fi, mobile phones or mobile phone masts.....the jobs where this could be done were few and far between and even then such jobs would almost inevitably entail use of computer Wi-fi which the appellant could not tolerate. Taken together the prospects of the appellant being able to ‘work’ ...were effectively nil”

172 US, 2014, Los Angeles Unified School District

Los Angeles Unified School District Accommodates Teacher Who Fell Ill After Wireless Installation

<http://www.prlog.org/12381499-los-angeles-unified-school-district-accommodates-teacher-who-fell-ill-after-wireless-installation.html>

On September 18, 2014, LAUSD, the second largest public school district in the US, officially accommodated teacher Ms. Anura Lawson by approving her request to have the Wi-Fi turned off in her classroom during the 2014-2015 school year and alternatively approving a reassignment to a different school site where Wi-Fi has yet to be installed.

The Middle School teacher reported that she fell seriously ill after a wireless system upgrade in her school in Spring 2014. She described her cardiac symptoms during a May 28, LAUSD Common Core Tech Project meeting. Ms. Lawson also stated, “The students are having nosebleeds and the main offices are refusing to do incident reports. I have had two seventh grade students bleeding out of their ears.” See <https://www.youtube.com/watch?v=wghaMbzRnb4>

This is the first accommodation in a US public school system for microwave sickness.

Microwave sickness, also known as electro hypersensitivity (EHS), is not widely recognized in the US. However, physicians in many other countries are familiar with this medical condition and the diagnosis is more common. EHS symptoms include: headaches, dizziness, anxiety, rapid heart beat (tachycardia) and irregular heart beat (arrhythmia), ear and nose bleeds, tinnitus, red and irritated eyes, increased mucous and upper airway congestion, itchy skin rashes, abdominal pain, poor focus and attention, memory and sleep problems.

In March 2012, the Austrian Medical Association recognized and developed EHS treatment guidelines. In the United States, adverse effects were identified before 1988 when a US Air Force Review stated that "Experimental evidence has shown that exposure to low intensity radiation can have a profound effect on biological processes."

The LAUSD Board of Education went ahead with a wireless technology plan in February 2013, even after they were presented with numerous letters from many noted medical doctors and researchers, including the American Academy of Environmental Medicine, imploring them to use wired technology in the classroom because of the health impacts from wireless radiation. See <http://wifiinschools.com/lausd-testimony.html>

Wireless LAUSD classrooms typically employ 30+ devices (iPads) in addition to an industrial-sized router. These devices all emit microwave radiation and represent an unprecedented level of exposure to children.

Decades of accumulated research show wireless radiation damages neurological, immune, and reproductive systems in addition to increasing cancer risk. Professor Olle Johansson, Karolinska Institute, Stockholm Sweden, has stated that wireless radiation exposure studies have indicated "irreversible sterility within five generations." As this damage is cumulative, the longer the radiation exposure, the greater the health impact over time.

"We are getting reports of headaches and cardiac issues from across the country. The time to act is now," stated a spokesperson for the National Association for Children and Safe Technology (NACST).

NACST is an organization dedicated to raising awareness of the health impacts of wireless radiation on children. They are calling for schools to use wired Internet only. Their website details both the accumulated research showing wireless radiation's acute as well as long term health impacts.

Letter from Los Angeles Unified School District

<http://thefullertoninformer.com/wp-content/uploads/2014/10/Lawson-Anura.Reasonable-...dation.092214-2-11.pdf>

The Committee reconvened September 9, 2014. After reviewing and taking into consideration all of the documentation you submitted as part of your request, the information you presented during the meeting, and reviewing alternate accommodations, the Committee approved your request to have the Wi-Fi turned off in your classroom during the 2014-2015 school year. As an alternate accommodation the Committee also approved a reassignment to a different school site where Wi-Fi has yet to be installed. If you wish to avail yourself to a reassignment, please contact Dina Bobadill-Aguilar or me.

173 US, 2012

Eger H, 2014, Umwelt - Medizin - Gesellschaft 2014; 27 (3): 176 - 181

Causal, Legally Recognized Proof of the Damage Potential of Technical Highfrequency Fields - a Case Report.

http://www.umg-verlag.de/umwelt-medizin-gesellschaft/314e_z.pdf

In the middle of the year 2006, an US-American patient moved to Bavaria for job reasons. At his new living place, he suffered from multiple symptoms mostly unknown from his past. First, **his night sleep was disturbed for several hours by different high and low tones. Later, he suffered from tachycardias, cephalgias and nose bleeding as well as pains all over the body. After that neurological deficits appeared also during the day: coordination difficulties, difficulties finding words, even word loss, confusion, difficulties in concentrating and dizziness.** At first, it was not possible for any doctor to associate this great variety of symptoms with an underlying disease.

Technical high-frequency measurements carried out in 2007 detected signals appearing at night which were above the limiting value stipulated in Germany by the 26th Bundesimmissionsschutzverordnung (BImSchV) (= German Emission Control Act) of 10 watts per square meter. The patient was able to define the beginning of the exposition at night as well as the time of his health problems without knowing the measurement results.

Therapeutically, the patient was locally de-exposed by moving to a different place. As a consequence, the symptoms gradually got better. The problems recurred under the daily highfrequency impact at technical working places, which is very common nowadays, so that working became impossible for the patient.

With the judicial acknowledgment of the electromagnetic sensitivity disorder in the year 2012, the diagnosed health damage was classified as pension relevant retroactively as of 2008.

RECOGNISED AS FUNCTIONAL IMPAIRMENT – HOSPITALS:

174 Johansson, 2006, Electromagn Biol Med. 2006;25(4):245-58.

Electrohypersensitivity: state-of-the-art of a functional impairment.

<http://www.ncbi.nlm.nih.gov/pubmed/17178584>

<http://www.national-toxic-encephalopathy-foundation.org/esen.pdf> (full paper)

Some hospitals in Sweden (e.g., in Umeå, Skellefteå, and Karlskoga) also have built special rooms with very low EMFs so that people who are hypersensitive can get medical care.

ACADEMIC BODIES URGE PROTECTION FOR THOSE WITH EHS:

175 Bioinitiative Report, 2014, Summary for the Public (2014 Supplement)

A report by 29 independent scientists and health experts from around the world (ten holding medical degrees (MDs), 21 PhDs, and three MSc, MA or MPHs) about possible risks from wireless technologies and electromagnetic fields. Among the authors are three former presidents of the Bioelectromagnetics Society (BEMS), and five full members of BEMS. One distinguished author is the Chair of the Russian National Committee on Non-Ionizing Radiation. Another is a Senior Advisor to the European Environmental Agency.

http://www.bioinitiative.org/report/wp-content/uploads/pdfs/sec01_2012_summary_for_public.pdf

RECOMMENDED ACTIONS

A. Defining Preventative Actions for Reduction in RFR Exposures

Sensitive Populations Must Be Protected

Safety standards for sensitive populations will more likely need to be set at lower levels than for healthy adult populations. **Sensitive populations include the developing fetus, the infant, children, the elderly, those with pre-existing chronic diseases, and those with developed electrical sensitivity (EHS).**

Protecting New Life – Infants and Children

Strong precautionary action and clear public health warnings are warranted immediately to help prevent a global epidemic of brain tumors resulting from the use of wireless devices (mobile phones and cordless phones). Commonsense measures to limit both ELF-EMF and RFR in the fetus and newborn infant (sensitive populations) are needed, especially with respect to avoidable exposures like baby monitors in the crib and baby isolettes (incubators) in hospitals that can be modified; and where education of the pregnant mother with respect to laptop computers, mobile phones and other sources of ELF-EMF and RFR are easily instituted. Wireless laptops and other wireless devices should be strongly discouraged in schools for children of all ages.

176 Seletun Panel, 2010

<http://wifischools.org.uk/resources/Seletun+2010.pdf>

The Panel strongly recommends that persons with electrohypersensitivity symptoms (EHS) be classified as functionally impaired rather than with 'idiopathic environmental disease' or similar indistinct categories. This terminology will encourage governments to make adjustments in the living environment to better address social and well-being needs of this subpopulation of highly sensitive members of society.

UN AND EUROPEAN PARLIAMENT – EQUAL OPPORTUNITIES FOR THOSE WITH EHS:

177 UN Convention on the Rights of Persons with Disabilities

<http://www.un.org/disabilities/convention/conventionfull.shtml>

e. Recognizing that disability is an evolving concept and **that disability results from the interaction between persons with impairments** and attitudinal and environmental barriers that hinders their full and effective participation in society on an equal basis with others,

Article 2 – Definitions

For the purposes of the present Convention:

"Discrimination on the basis of disability" means any distinction, exclusion or restriction on the basis of disability which has the purpose or effect of impairing or nullifying the recognition, **enjoyment or exercise, on an equal basis with others**, of all human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other field. It includes all forms of discrimination, including denial of reasonable accommodation;

178 UN Resolution 48/96, Annex of 20 December 1993 (UN 1993)

The Standard Rules on the Equalization of Opportunities for Persons with Disabilities

<http://www.un.org/esa/socdev/enable/dissre00.htm>

II. Target Areas for Equal Participation

Rule 5. Accessibility

States should recognize the overall importance of accessibility in the process of the equalization of opportunities in all spheres of society. For persons with disabilities of any kind, States should (a) introduce programmes of action to make the physical environment accessible; and (b) undertake measures to provide access to information and communication.

- Access to the physical environment
 - States should initiate measures to remove the obstacles to participation in the physical environment. Such measures should be to develop standards and guidelines and to consider

enacting legislation to **ensure accessibility to various areas in society, such as housing, buildings, public transport services and other means of transportation, streets and other outdoor environments.**

- States should ensure that architects, construction engineers and others who are professionally involved in the design and construction of the physical environment have access to adequate information on disability policy and measures to achieve accessibility.
- Accessibility requirements should be included in the design and construction of the physical environment from the beginning of the designing process.
- **Organizations of persons with disabilities should be consulted when standards and norms for accessibility are being developed.** They should also be involved locally from the initial planning stage when public construction projects are being designed, thus ensuring maximum accessibility.
- Access to information and communication
 - **Persons with disabilities and, where appropriate, their families and advocates should have access to full information on diagnosis, rights and available services and programmes, at all stages. Such information should be presented in forms accessible to persons with disabilities.**
 - States should develop strategies to make information services and documentation accessible for different groups of persons with disabilities. Braille, tape services, large print and other appropriate technologies should be used to provide access to written information and documentation for persons with visual impairments. Similarly, appropriate technologies should be used to provide access to spoken information for persons with auditory impairments or comprehension difficulties.
 - Consideration should be given to the use of sign language in the education of deaf children, in their families and communities. Sign language interpretation services should also be provided to facilitate the communication between deaf persons and others.
 - **Consideration should also be given to the needs of people with other communication disabilities.**
 - States should encourage the media, especially television, radio and newspapers, to make their services accessible.
 - **States should ensure that new computerized information and service systems offered to the general public are either made initially accessible or are adapted to be made accessible to persons with disabilities.**
 - Organizations of persons with disabilities should be consulted when measures to make information services accessible are being developed.

Rule 6. Education

States should recognize the principle of equal primary, secondary and tertiary educational opportunities for children, youth and adults with disabilities, in integrated settings. They should ensure that the education of persons with disabilities is an integral part of the educational system.

- General educational authorities are responsible for the education of persons with disabilities in integrated settings. **Education for persons with disabilities should form an integral part of national educational planning, curriculum development and school organization.**
- Education in mainstream schools presupposes the provision of interpreter and other appropriate support services. Adequate accessibility and support services, designed to meet the needs of persons with different disabilities, should be provided.
- Parent groups and organizations of persons with disabilities should be involved in the education process at all levels.
- **In States where education is compulsory it should be provided to girls and boys with all kinds and all levels of disabilities, including the most severe.**
- Special attention should be given in the following areas:
 - Very young children with disabilities;
 - Pre-school children with disabilities;
 - Adults with disabilities, particularly women.
- To accommodate educational provisions for persons with disabilities in the mainstream, States should:
 - Have a clearly stated policy, understood and accepted at the school level and by the wider community;
 - Allow for curriculum flexibility, addition and adaptation;
 - Provide for quality materials, ongoing teacher training and support teachers.

- Integrated education and community-based programmes should be seen as complementary approaches in providing cost-effective education and training for persons with disabilities. **National community-based programmes should encourage communities to use and develop their resources to provide local education to persons with disabilities.**
- In situations where the general school system does not yet adequately meet the needs of all persons with disabilities, **special education may be considered.** It should be aimed at preparing students for education in the general school system. The quality of such education should reflect the same standards and ambitions as general education and should be closely linked to it. **At a minimum, students with disabilities should be afforded the same portion of educational resources as students without disabilities. States should aim for the gradual integration of special education services into mainstream education.** It is acknowledged that in some instances special education may currently be considered to be the most appropriate form of education for some students with disabilities.
- Owing to the particular communication needs of deaf and deaf/blind persons, their education may be more suitably provided in schools for such persons or special classes and units in mainstream schools. At the initial stage, in particular, special attention needs to be focused on culturally sensitive instruction that will result in effective communication skills and maximum independence for people who are deaf or deaf/blind.

Rule 7. Employment

States should recognize the principle that **persons with disabilities must be empowered to exercise their human rights, particularly in the field of employment. In both rural and urban areas they must have equal opportunities for productive and gainful employment in the labour market.**

- Laws and regulations in the employment field must not discriminate against persons with disabilities and must not raise obstacles to their employment.
- States should actively support the integration of persons with disabilities into open employment. This active support could occur through a variety of measures, such as vocational training, incentive-oriented quota schemes, reserved or designated employment, loans or grants for small business, exclusive contracts or priority production rights, tax concessions, contract compliance or other technical or financial assistance to enterprises employing workers with disabilities. **States should also encourage employers to make reasonable adjustments to accommodate persons with disabilities.**
- States' action programmes should include:
 - **Measures to design and adapt workplaces and work premises in such a way that they become accessible to persons with different disabilities;**
 - **Support for the use of new technologies and the development and production of assistive devices, tools and equipment and measures to facilitate access to such devices and equipment for persons with disabilities to enable them to gain and maintain employment;**
 - **Provision of appropriate training and placement and ongoing support such as personal assistance and interpreter services.**
- **States should initiate and support public awareness-raising campaigns designed to overcome negative attitudes and prejudices concerning workers with disabilities.**
- **In their capacity as employers, States should create favourable conditions for the employment of persons with disabilities in the public sector.**
- **States, workers' organizations and employers should cooperate to ensure equitable recruitment and promotion policies, employment conditions, rates of pay, measures to improve the work environment in order to prevent injuries and impairments and measures for the rehabilitation of employees who have sustained employment-related injuries.**
- The aim should always be for persons with disabilities to obtain employment in the open labour market. For persons with disabilities whose needs cannot be met in open employment, small units of sheltered or supported employment may be an alternative. It is important that the quality of such programmes be assessed in terms of their relevance and sufficiency in providing opportunities for persons with disabilities to gain employment in the labour market.
- Measures should be taken to include persons with disabilities in training and employment programmes in the private and informal sectors.
- States, workers' organizations and employers should cooperate with organizations of persons with disabilities concerning all measures to create training and employment opportunities, including flexible hours, part-time work, job-sharing, self-employment and attendant care for persons with disabilities.

<http://www.europarl.europa.eu/sides/getDoc.do?type=TA&language=EN&reference=P6-TA-2009-216>

28. Calls on Member States to follow the example of Sweden and to recognise persons that suffer from electrohypersensitivity as being disabled so as to grant them adequate protection as well as equal opportunities;

NOTABLE PERSONS WITH EHS:

180 Dr Gro Harlem Brundtland, Former Director-General of WHO and Norwegian Prime Minister

<http://www.magdahavas.com/gro-harlem-brundtland-talks-at-the-university-of-waterloo/>

Dr. Brundtland said, "Based on your question, I assume you know that I am electrically sensitive. I never place a mobile phone next to my head because in one second I would develop a bad headache. I use the phone in speaker mode," and she demonstrated with her cell phone, holding it away from her head.

181 Nokia's former Technology Chief, Matti Niemelä

<http://betweenrockandhardplace.wordpress.com/2014/10/18/former-nokia-technology-chief-mobile-phones-wrecked-my-health/>

For Tampere-based Matti Niemelä, age 44, life was like in the movies when he as a young man was recruited to work for Nokia in 1997. The brilliant young man quickly advanced to become Nokia's Chief Technology Officer for ten years, and was involved in developing the world's first mobile phones, memory sticks and WLAN [Wi-Fi] connections.

In 2007, Niemelä's career hit a brick wall as his health finally failed. Today, he is only able to move using a walker.

Niemelä refuses to use a wheelchair.

– The irony of this is that I'm no longer able to use any of those devices that I had been developing, Niemelä says with a smile.....

.....**Even a small radiation exposure is too much.**

– I can no longer go to the cinema or stay in public areas with lots of radiation for long. I have not been anywhere for a long time says Niemelä who in his forties, must accept that the four walls of his home are now a prison.....

.... Niemelä explains that the subject of mobile phone radiation has always been kept silent at Nokia.

– You couldn't talk about it within the company. Yet, among the staff, it was speculated whether the radiation could cause damage. However, no one dared to bring it up, because it could get them fired.

Niemelä says he brought up the matter with the doctor for the first time in 2006.

– The doctor told me about a number of patients who are suffering from the same symptoms as me, Niemelä reveals. Niemelä is particularly concerned about the children and their mobile phone use, because the continuous exposure to the ear and head does not do any good.

– These things have been kept silent for too long. I hope it will become possible to discuss the symptoms openly, and without fear.

MEDICAL GUIDELINES EXIST:

See also: [Tuengler & von Klitzing 2013⁹⁵](#).

182 Austrian Medical Association, 2012

Guideline of the Austrian Medical Association for diagnosis and treatment of EMF-related health problems and illnesses (EMF Syndrome)

<http://www.magdahavas.com/wordpress/wp-content/uploads/2012/06/Austrian-EMF-Guidelines-2012.pdf>

5. Diagnosis (page 11)

A diagnosis of EMF syndrome will largely be based on a comprehensive case history, focusing in particular on correlations between health problems and times and places of EMF exposure, as well as the progression of symptoms over time. In addition, measurements of EMF exposure and the results of additional diagnostic tests (laboratory tests, cardiovascular system) serve to support the diagnosis. Moreover, all other potential causes should be excluded as far as possible.

We recommend that the code Z58.4 (Exposure to radiation) under the International Classification of Diseases (ICD-10) be used for EMF syndrome for the time being.

183 Austrian Medical Association, 2012

Guideline of the Austrian Medical Association for diagnosis and treatment of EMF-related health problems and illnesses (EMF Syndrome)

<http://www.magdahavas.com/wordpress/wp-content/uploads/2012/06/Austrian-EMF-Guidelines-2012.pdf>

How to proceed if EMF-related health problems are suspected (page 4)

The recommended approach to diagnosis and treatment is intended as an aid and should, of course, be modified as each individual case requires.

1. History of health problems and EMF exposure
2. Examination and findings
3. Measurement of EMF exposure
4. Prevention or reduction of EMF exposure
5. Diagnosis 6. Treatment
6. Treatment (page 11)

The primary method of treatment should consist in the prevention or reduction of EMF exposure, taking care to reduce or eliminate all sources of EMF if possible. Many examples have shown that such measures can prove effective.

184 **Canadian Human Rights Commission, May 2007**

The Medical Perspective on Environmental Sensitivities

http://www.chrc-ccdp.gc.ca/sites/default/files/envsensitivity_en.pdf

A Diagnostic criteria (page 4)

With regard to multiple chemical sensitivity, thirty-four experienced North American physicians and researchers who had examined patterns of symptoms in thousands of people reached a consensus regarding criteria to establish a diagnosis:

- symptoms are reproducible with repeated exposure;
- the condition is chronic;
- low levels of exposure [lower than previously or commonly tolerated] result in manifestations of the syndrome;
- symptoms improve or resolve when the incitants are removed;
- responses occur to multiple chemically unrelated substances; and
- symptoms involve multiple organ systems.

[Author's note: Whilst these diagnostic criteria were devised for multiple chemical sensitivity (MCS) they are applicable also for EHS, with a correction to the 5th bullet point for 'responses occur to multiple electromagnetic field exposures; and'.]

A systematic literature review confirmed the diagnostic criteria, and suggested that neurological symptoms could be an additional criterion.

The consensus diagnostic criteria were also validated, as they identified those most and least likely to be affected among 2,546 patients in Toronto medical practices with high and low prevalence of patients with sensitivities. In the same study, a combination of four neurological symptoms also discerned people most likely affected by multiple chemical sensitivities: **having a stronger sense of smell than others; feeling dull/groggy; feeling "spacey;" plus having difficulty concentrating. A pattern consistent with these diagnostic criteria is also reported for sensitivities to electromagnetic phenomena.**

VI Diagnosis and treatment of sensitivities (page 27)

Investigation requires a complete assessment of the patient's chronological health and exposure histories, a thorough physical examination and routine tests. Other possible conditions are ruled out, or are treated so that their contributions to ill health are minimized. Then, the consensus diagnostic criteria for environmental sensitivities, strengthened by discriminating symptoms, may be used to "rule in" the condition of environmental sensitivities, using a diagnostic checklist for physicians.

185 Genuis and Lipp, 2012, Sci Total Environ. 2012 Jan 1;414:103-12.

Electromagnetic hypersensitivity: fact or fiction?

<http://www.ncbi.nlm.nih.gov/pubmed/22153604>

3. Management of electromagnetic hypersensitivity (page 107)

[Author's note: Management guidelines in this paper are categorised 1. Avoidance of triggers, 2. Biochemical restoration, 3. Elimination of bioaccumulated toxicant load].

ADVICE TO LOWER EXPOSURE:

See also: Also refer to Sweden 2000¹⁶⁴, Canadian Human Rights 2007¹⁶⁷.

186 American Academy of Environmental Medicine (AAEM)

American Academy of Environmental Medicine Recommendations Regarding Electromagnetic and Radiofrequency Exposure (Dec 2012)

<http://aaemonline.org/AAEMEMFmedicalconditions.pdf>

Physicians of the American Academy of Environmental Medicine recognize that patients are being adversely impacted by electromagnetic frequency (EMF) and radiofrequency (RF) fields and are becoming more electromagnetically sensitive.

The AAEM recommends that physicians consider patients' total electromagnetic exposure in their diagnosis and treatment, as well as recognition that electromagnetic and radiofrequency field exposure may be an underlying cause of a patient's disease process.

Based on double-blinded, placebo controlled research in humans, medical conditions and disabilities that would more than likely **benefit from avoiding electromagnetic and radiofrequency exposure** include, but are not limited to:

- Neurological conditions such as paresthesias, somnolence, cephalgia, dizziness, unconsciousness, depression
- Musculoskeletal effects including pain, muscle tightness, spasm, fibrillation
- Heart disease and vascular effects including arrhythmia, tachycardia, flushing, edema
- Pulmonary conditions including chest tightness, dyspnea, decreased pulmonary function
- Gastrointestinal conditions including nausea, belching
- Ocular (burning)
- Oral (pressure in ears, tooth pain)
- Dermal (itching, burning, pain)
- Autonomic nervous system dysfunction (dysautonomia).

[Author's note: the above are all symptoms of electromagnetic hypersensitivity].

187 ANSES (French Government Agency for Food, Environmental and Occupational Health), 2013

<https://www.anses.fr/en/content/radiofrequencies-mobile-telecommunications-and-wireless-technology>

Radiofrequencies, mobile telecommunications and wireless technology (updated 16/4/2013)

Health effects of wireless communication technologies and other radiofrequency applications

Recommendations of the Agency

The possible impact of radiofrequency exposure on health is a subject of debate in the scientific community, in an environment where technologies have been rapidly deployed. This is specifically due to the lack of clear evidence of non-thermal effects and because there is still uncertainty surrounding evidence of various effects on cell mechanisms. This issue is also part of the wider debate concerning multiple environmental exposure to low levels of electromagnetic fields, and the possible associated health risks. Additional research studies carried out with suitable methodologies are justified in order to provide answers to these various questions.

However, given the level of uncertainty, the Agency emphasises that reduction of environmental exposure should be considered in all cases where this is possible, particularly through deployment of the best available technologies at economically acceptable costs.

There is indeed potential for reduction in the area of exposure to radiofrequencies. **Examples include the use of mobile telephones with low specific absorption rates (SARs), lowering levels in zones with the highest degree of exposure, sharing transmitters, and measured use of wireless technologies.**

188 Austrian Medical Association, 2012

Guideline of the Austrian Medical Association for diagnosis and treatment of EMF-related health problems and illnesses (EMF Syndrome)

<http://www.magdahavas.com/wordpress/wp-content/uploads/2012/06/Austrian-EMF-Guidelines-2012.pdf>

4. Prevention or reduction of EMF exposure Preventing or reducing EMF exposure after consultation of a measurement engineer is advantageous for several reasons: a) to prevent and reduce risks to the individual and to public health, b) to treat the causes of EMF syndrome and c) to aid in identifying any links to health problems.

189 BioInitiative Report, 2012.

A report by 29 independent scientists and health experts from around the world (ten holding medical degrees (MDs), 21 PhDs, and three MSc, MA or MPHs) about possible risks from wireless technologies and electromagnetic fields. Among the authors are three former presidents of the Bioelectromagnetics Society (BEMS), and five full members of

BEMS. One distinguished author is the Chair of the Russian National Committee on Non-Ionizing Radiation. Another is a Senior Advisor to the European Environmental Agency.

<http://www.bioinitiative.org/conclusions/>

SENSITIVE POPULATIONS MUST BE PROTECTED

Safety standards for sensitive populations will more likely need to be set at lower levels than for healthy adult populations. **Sensitive populations include the developing fetus, the infant, children, the elderly, those with pre-existing chronic diseases, and those with developed electrical sensitivity (EHS).**

190 Canadian Human Rights Commission, May 2007

The Medical Perspective on Environmental Sensitivities

http://www.chrc-ccdp.gc.ca/sites/default/files/envsensitivity_en.pdf

Abstract (page ii)

Avoidance of triggers is an essential step to regaining health.

Executive Summary (page iii)

The symptoms are reproducible with repeated exposures, and resolve with avoidance of the environmental factor(s).

VI Diagnosis and treatment of sensitivities (page 27)

Once a diagnosis of environmental sensitivities has been established, there are a variety of strategies for treating and living with the condition. **Avoidance of symptom triggers** and removal of toxic chemicals stored in the body are key to treating environmental sensitivities.

191 International Doctors Appeal, 2012.

[Author's note: point 7 specifically relates to protection via reduced exposure].

Observations & Findings: Wireless Radiation Poses a Health Risk. Physicians Demand Overdue Precaution!

<http://freiburger-appell-2012.info/en/observations-findings.php>

The number of those who suffer from electrohypersensitivity is steadily growing. They can develop severe symptoms immediately or even several hours after the exposure to technical electromagnetic fields. As physicians we welcome that Sweden has recognized electrohypersensitivity as a functional impairment. We would also like to point out and emphasize that the European Parliament has called on its member states "to follow the example of Sweden," and that U.S. State Governors have raised public awareness about the serious consequences of electrohypersensitivity. The initiative of the Austrian Medical Association, which has released a guideline for the diagnosis and treatment of EMF-related health problems and illnesses, hopefully will also catch on in other countries.

Recommendations:

<http://freiburger-appell-2012.info/en/recommendations.php>

More than 1000 physicians signed the "Freiburg Appeal" in 2002. It was translated into many languages. As many as **36,000** people from all over the world support its warning about the dangers of radio-frequency radiation. Today—ten years later—we as physicians and scientists call again on our colleagues and the wider global community, but also on all politicians around the world.

As physicians and scientists, we hereby call on our colleagues; on the leaders of federal, state, and local governments; but also on the wider community to take action and implement the following precautionary strategies, which also include fundamental human rights:

1. Protect the inviolability of the home by minimizing radio-frequency exposure levels, which penetrate through the walls of one's own home.
2. Ensure considerably lower radio-frequency radiation exposures as well as exposure limits that reliably protect humans and nature from adverse biological effects of electromagnetic fields. **Any further expansion of wireless technologies is irresponsible.**
3. **Prefer wired solutions for home use and public institutions, especially at preschools, schools, colleges, universities, nursing homes, and hospitals.**
4. Cutback and reprogram continuously emitting devices such as cordless phones, wireless Internet access (Wi-Fi), and wireless smart meters so that they only operate and emit radio-frequency radiation on demand when being used.
5. Provide special protection for children and adolescents: **Children below the age of 8 should not use cell phones and cordless phones; children and adolescents between the ages 8 and 16 should also not use cell phones or only use them in the case of an emergency.** Cell phone and online device advertisements must not be directed at children and adolescents, and these devices should not be used at schools.
6. Attach clearly visible warning labels and safety guidelines for lowering the radiation exposure on cell phones and other wireless devices, including instruction manuals. An important reminder: do not carry a cell phone right next to your body when it is turned on.

7. Identify and clearly mark protected zones for electrosensitive people; establish public areas without wireless access or coverage, especially on public transport, similar to smoke-free areas for nonsmokers.

8. Promote the development of communication technologies and electricity use that is more compatible with health. Prefer wired solutions for home use and public facilities. Expand fiber-optic networks as the foundation of a modern, sustainable, and performance-based technology that meets the ever-increasing demand for higher data transmission rates.

9. Provide government funding for industry-independent research and education that do not dismiss strong scientific and medical findings of potential risks, but rather work to clarify those risks.

192 Parliamentary Assembly of the Council of Europe, Resolution 1815 (2011)

<http://www.assembly.coe.int/Mainf.asp?link=/Documents/AdoptedText/ta11/ERES1815.htm> (Final resolution)

5. As regards standards or threshold values for emissions of electromagnetic fields of all types and frequencies, the Assembly strongly recommends that the ALARA (as low as reasonably achievable) principle is applied, covering both the so-called thermal effects and the athermic or biological effects of electromagnetic emissions or radiation. Moreover, the precautionary principle should be applied when scientific evaluation does not allow the risk to be determined with sufficient certainty. Given the context of growing exposure of the population, in particular that of vulnerable groups such as young people and children, there could be extremely high human and economic costs if early warnings are neglected.

8. In light of the above considerations, the Assembly recommends that the member states of the Council of Europe:

8.1. in general terms:

8.1.1. take all reasonable measures to reduce exposure to electromagnetic fields, especially to radio frequencies from mobile phones, and particularly the exposure to children and young people who seem to be most at risk from head tumours;

8.1.2. reconsider the scientific basis for the present standards on exposure to electromagnetic fields set by the International Commission on Non-Ionising Radiation Protection, which have serious limitations, and apply ALARA principles, covering both thermal effects and the athermic or biological effects of electromagnetic emissions or radiation;

8.1.3. put in place information and awareness-raising campaigns on the risks of potentially harmful long-term biological effects on the environment and on human health, especially targeting children, teenagers and young people of reproductive age;

8.1.4. **pay particular attention to "electrosensitive" people who suffer from a syndrome of intolerance to electromagnetic fields and introduce special measures to protect them, including the creation of wave-free areas not covered by the wireless network;**

193 Swiss Physicians for the Environment (MfE), 2012 (Basel, March 16, 2012)

Non-ionizing radiation (NIR): As much as necessary and as little as possible

http://www.aefu.ch/fileadmin/user_upload/aefu-data/b_documents/Aktuell/120316_Brief_NIS.pdf

Dear Federal Councillors, Dear national councilors, Dear StänderätInnen

The International Agency IARC cancer called mobile phone radiation as "possibly carcinogenic". The IARC classifies the cancer risk of this radiation is thus equal to one as in prohibited rightly insects DDT.

The radiation exposure from mobile phone has increased greatly in recent years and will continue to rise.

We, the Doctors for the Environment (AefU) note with concern that the NIS Regulation, the Swiss population - but especially sensitive population groups such as children and pregnant women - does not provide sufficient negative Health- impacts of the electromagnetic fields protects.

We appeal to you in your decisions and actions around electricity and radio equipment applications, the precautionary principle "as much as necessary and as little as possible" taken into account.

3. The precautionary principle should be applied to non-ionizing radiation (NIR) strictly We therefore call on you in your decisions

- given the recent studies on a tightening of NIS Regulation to work
- a precaution field reduced infrastructure planning to pursue
- legal basis for mandatory declaration of NIS-emitting devices to create
- the upcoming expansion of the electricity network without additional exposure of the population to plan
- continuous, independent, practical and interdisciplinary research

Focus on vulnerable groups such as children, pregnant women, chronically ill to assist and electro-sensitive patients.

[Author's note: translated using Google Translate].

194 US, 2005, National Institute of Building Sciences

IEQ Indoor Environmental Quality

http://web.archive.org/web/20060714175343/ieq.nibs.org/ieq_project.pdf (page 11)

The National Institute for Occupational Safety and Health (NIOSH) notes that scientific studies have raised questions about the possible health effects of EMF's. **NIOSH recommends the following measures for those wanting to reduce EMF exposure – informing workers and employers about possible hazards of magnetic fields, increasing workers' distance from EMF sources, using low-EMF designs wherever possible (e.g., for layout of office power supplies), and reducing EMF exposure times .**

AVOIDANCE ONLY RELIABLE FORM OF MANAGEMENT:

See also: Hagström et al, 2013¹³⁸.

195 Rööslä et al, 2004, Int J Hyg Environ Health. 2004 Feb;207(2):141-50.

Symptoms of ill health ascribed to electromagnetic field exposure--a questionnaire survey.

<http://www.ncbi.nlm.nih.gov/pubmed/15031956>

From June 2001, health questionnaires were distributed to people who complained about symptoms of ill health which they ascribed to exposure to electromagnetic fields (EMF). The objective of the survey was to gain a better knowledge of the anxieties of complainants, to obtain hints of possible problems and of actions that should be taken to solve the problems. The survey was not designed to establish a causal association between exposure to EMF and symptoms of ill health. Within one year, 429 questionnaires were returned of which 394 persons reported symptoms. The average age of the complainants was 51.0 years and 57 percent were female. The complainants were older, had a higher educational level and were more likely to be married compared to the general Swiss population. A mean of 2.7 different symptoms were reported. **Sleep disorders (58%), headaches (41%), nervousness or distress (19%), fatigue (18%), and concentration difficulties (16%) were most common complaints. Complainants related their symptoms most frequently to exposure to mobile phone base stations (74%), followed by mobile phones (36%), cordless phones (29%) and power lines (27%).** No distinct symptoms related to a specific field source could be identified. Eighty-five percent of the people who consulted a public authority because of their symptoms were unsatisfied with the response, whereas consultation of self-help groups or building ecologists usually fulfilled expectations. Two thirds of complainants had taken some action to reduce their symptoms. **The most common measure was to avoid exposure if possible. Removing or disconnecting indoor sources was judged to be the most effective action.**

IT IS A CLINICAL DIAGNOSIS:

See also: Austrian Guidelines 2012¹⁸².

CHILDREN HAVE EHS:

196 Department for Education, Supporting pupils at school with medical conditions, April 2014

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/349435/Statutory_guidance_on_supporting_pupils_at_school_with_medical_conditions.pdf

Excerpts:

Key points (page 4)

- Pupils at school with medical conditions should be properly supported so that they have full access to education, including school trips and physical education.
- Governing bodies must ensure that arrangements are in place in schools to support pupils at school with medical conditions.
- Governing bodies should ensure that school leaders consult health and social care professionals, pupils and parents to ensure that the needs of children with medical conditions are effectively supported.

Introduction (page 5)

1. The aim is to ensure that all children with medical conditions, in terms of both physical and mental health, are properly supported in school **so that they can play a full and active role in school life, remain healthy and achieve their academic potential.**
2. It is crucial that schools receive and fully consider advice from healthcare professionals **and listen to and value the views of parents and pupils.**
3. In addition to the educational impacts, there are social and emotional implications associated with medical conditions. In particular, long-term absences due to health problems affect children's educational attainment, impact on their ability to integrate with their peers and affect their general wellbeing and emotional health.
4. Some children with medical conditions may be considered to be disabled under the definition set out in the Equality Act 2010. Where this is the case governing bodies must comply with their duties under that Act.

The role of governing bodies, proprietors and management committees (page 7)

5 The governing body, proprietor or management committee remains legally responsible and accountable for fulfilling their statutory duty.

6. The governing body must ensure that arrangements are in place to support pupils with medical conditions. In doing so they should ensure that **such children can access and enjoy the same opportunities at school as any other child.**

8. The governing body should ensure that their arrangements give parents and pupils confidence in the school's ability to provide effective support for medical conditions in school. They should ensure that staff are properly trained to provide the support that pupils need.

9. **Children and young people with medical conditions are entitled to a full education and have the same rights of admission to school as other children.** This means that no child with a medical condition should be denied admission or prevented from taking up a place in school because arrangements for their medical condition have not been made. However, in line with their safeguarding duties, **governing bodies should ensure that pupils' health is not put at unnecessary risk.**

Policy implementation (page 8)

12. Governing bodies should ensure that the arrangements they set up include details on how the school's policy will be implemented effectively, including a named person who has overall responsibility for policy implementation.

Procedure to be followed when notification is received that a pupil has a medical condition (page 9)

14. **Schools do not have to wait for a formal diagnosis before providing support to pupils. In cases where a pupil's medical condition is unclear, or where there is a difference of opinion, judgements will be needed about what support to provide based on the available evidence.**

Individual healthcare plans (page 10)

17. Partners should agree who will take the lead in writing the plan, but responsibility for ensuring it is finalised and implemented rests with the school. The governing body should ensure that plans are reviewed at least annually, or earlier if evidence is presented that the child's needs have changed. They should be developed with the child's best interests in mind and ensure that the school assesses and manages risks to the child's education, health and social wellbeing, and minimises disruption.

Roles and responsibilities (page 12)

Headteachers - They should also make sure that school staff are appropriately Insured.

Pupils – with medical conditions will often be best placed to provide information about how their condition affects them. They should be fully involved in discussions about their medical support needs and contribute as much as possible to the development of, and comply with, their individual healthcare plan. Other pupils will often be sensitive to the needs of those with medical conditions.

Parents – should provide the school with sufficient and up-to-date information about their child's medical needs. They may in some cases be the first to notify the school that their child has a medical condition. Parents are key partners and should be involved in the development and review of their child's individual healthcare plan, and may be involved in its drafting.

Local authorities – Statutory guidance for local authorities sets out that they should be ready to make arrangements under this duty when it is clear that a child will be away from school **for 15 days or more** because of health needs (whether consecutive or cumulative across the school year).

Ofsted – their inspection framework places a clear emphasis on meeting the needs of disabled children and pupils with SEN, and considering the quality of teaching and the progress made by these pupils. Inspectors are already briefed to consider the needs of pupils with chronic or long-term medical conditions alongside these groups and to report on how well their needs are being met. Schools are expected to have a policy dealing with medical needs and to be able to demonstrate that this is implemented effectively.

Staff training and support (page 15)

29. This includes **preventative** and emergency measures so that staff can recognise and act quickly when a problem occurs.

30. **The family of a child will often be key in providing relevant information to school staff about how their child's needs can be met**, and parents should be asked for their views. They should provide specific advice, but should not be the sole trainer.

Day trips, residential visits and sporting activities (page 18)

41. Schools should consider what reasonable adjustments they might make to enable children with medical needs **to participate fully and safely on visits**. It is best practice to carry out a risk assessment so that planning arrangements take account of any steps needed to ensure that pupils with medical conditions are included.

Other issues for consideration (page 18)

Schools are advised to consider purchasing a defibrillator as part of their first-aid equipment

Unacceptable practice (page 19)

43. It is not generally acceptable practice to:

- ignore the views of the child or their parents; or ignore medical evidence or opinion (although this may be challenged);
- No parent should have to give up working because the school is failing to support their child's medical needs;
- prevent children from participating, or create unnecessary barriers to children participating in any aspect of school life, including school trips

Liability and indemnity (page 20)

44. **Governing bodies of maintained schools and management committees of PRUs should ensure that the appropriate level of insurance is in place and appropriately reflects the level of risk.** [Author's note: the author is not aware of any insurance companies that insured against health effects of RF radiation exposure].

46. In the event of a claim alleging negligence by a member of staff, civil actions are likely to be brought against the employer.

Further sources of information (page 21)

Other safeguarding legislation

Section 21 of the Education Act 2002 provides that governing bodies of maintained schools must, in discharging their functions in relation to the conduct of the school, **promote the wellbeing of pupils at the school**.

Section 175 of the Education Act 2002 provides that governing bodies of maintained schools must make arrangements for ensuring that their functions relating to the conduct of the school are exercised with a view to **safeguarding and promoting the welfare of children who are pupils at the school**. Paragraph 7 of Schedule 1 to the Independent School Standards (England) Regulations 2010 set this out in relation to academy schools and alternative provision academies.

Section 3 of the Children Act 1989 provides a duty on a person with the care of a child (who does not have parental responsibility for the child) to **do all that is reasonable in all the circumstances for the purposes of safeguarding or promoting the welfare of the child**.

Section 17 of the Children Act 1989 gives local authorities a general duty to **safeguard and promote the welfare of children in need in their area**.

Section 10 of the Children Act 2004 provides that the local authority must make arrangements to promote co-operation between the authority and relevant partners (including the governing body of a maintained school, the proprietor of an academy, clinical commissioning groups and the NHS Commissioning Board) with a view to **improving the wellbeing of children, including their physical and mental health**, protection from harm and neglect, and education. **Relevant partners are under a duty to co-operate in the making of these arrangements**.

The NHS Act 2006: Section 3 gives Clinical Commissioning Groups a duty to arrange for **the provision of health services to the extent the CCG considers it necessary to meet the reasonable needs of the persons for whom it is responsible**.

Section 3A provides for a CCG to arrange such services as it considers appropriate to **secure improvements in physical and mental health of, and in the prevention, diagnosis and treatment of illness**, in, the persons for whom it is responsible. **Section 2A provides for local authorities to secure improvements to public health**, and in doing so, to commission school nurses.

Governing Bodies' duties towards disabled children and adults are included in the **Equality Act 2010**, and the key elements are as follows:

- **They must not discriminate against**, harass or victimise **disabled children** and young people [Author's note: EHS is classified as a functional impairment under the Disability Act under some countries.¹⁶⁴]
- They must make reasonable adjustments to ensure that disabled children and young people are not at a substantial disadvantage compared with their peers. This duty is anticipatory: adjustments must be planned and put in place in advance, to prevent that disadvantage

Other relevant legislation (page 22)

Section 2 of the Health and Safety at Work Act 1974, and the associated regulations, provides that it is the duty of the employer (the local authority, governing body or academy trust) to **take reasonable steps to ensure that staff and pupils are not exposed to risks to their health and safety.**

VULNERABLE GROUPS AND WHITE ZONES:

197 **Benevento Resolution, 2006, ICEMS** (International Commission for Electromagnetic Safety).

http://www.icems.eu/benevento_resolution.htm

We encourage governments to adopt a framework of guidelines for public and occupational EMF exposure that reflect the Precautionary Principle.

Promote alternatives to wireless communication systems.

Designate wireless-free zones in cities, in public buildings (schools, hospitals, residential areas) and, on public transit, to permit access by persons who are hypersensitive to EMF.

198 **International Doctors Appeal, 2012.**

Radio-frequency Radiation Poses a Health Risk. Physicians Demand Overdue Precaution.

<http://freiburger-appell-2012.info/en/observations-findings.php>

More than 1000 physicians signed the “Freiburg Appeal” in 2002. It was translated into many languages. As many as **36,000** people from all over the world support its warning about the dangers of radio-frequency radiation. Today—ten years later—we as physicians and scientists call again on our colleagues and the wider global community, but also on all politicians around the world.

As physicians and scientists, we hereby call on our colleagues; on the leaders of federal, state, and local governments; but also on the wider community to take action and implement the following precautionary strategies, which also include fundamental human rights:

7. Identify and clearly mark protected zones for electrosensitive people; establish public areas without wireless access or coverage, especially on public transport, similar to smoke-free areas for nonsmokers.

199 **Parliamentary Assembly of the Council of Europe, Resolution 1815 (2011)**

<http://www.assembly.coe.int/Mainf.asp?link=/Documents/AdoptedText/ta11/ERES1815.htm> (Final resolution)

8. In light of the above considerations, the Assembly recommends that the member states of the Council of Europe:

8.1. in general terms:

8.1.4. **pay particular attention to “electrosensitive” people who suffer from a syndrome of intolerance to electromagnetic fields and introduce special measures to protect them, including the creation of wave-free areas not covered by the wireless network;**

SOCIOECONOMIC IMPACT OF EHS AND HUMAN RIGHTS:

200 **Canadian Human Rights Commission, May 2007**

The Medical Perspective on Environmental Sensitivities

http://www.chrc-ccdp.gc.ca/sites/default/files/envsensitivity_en.pdf

Executive Summary (page v)

There are high costs to society of not caring for people with sensitivities, and workplace environmental quality affects workers’ productivity, health and attendance.

ALL EHS PERSONS REQUIRE ‘COMPREHENSIVE HEALTH EVALUATION’:

201 De Luca et al, 2014, Mediators Inflamm. 2014;2014:924184.

Metabolic and genetic screening of electromagnetic hypersensitive subjects as a feasible tool for diagnostics and intervention.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4000647/>

Radiation Sickness; Reliable disease biomarkers characterizing and identifying electrohypersensitivity and multiple chemical sensitivity as two etiopathogenic aspects of a unique pathological disorder.
Rev Environ Health. (Prof. Belpomme et al); 2015

Belpomme D, Campagnac C, Irigaray P. Reliable disease biomarkers characterizing and identifying electrohypersensitivity and multiple chemical sensitivity as two etiopathogenic aspects of a unique pathological disorder. Rev Environ Health. 2015 Dec 1;30(4):251-71. doi: 10.1515/reveh-2015-0027.

Much of the controversy over the causes of electro-hypersensitivity (EHS) and multiple chemical sensitivity (MCS) lies in the absence of both recognized clinical criteria and objective biomarkers for widely accepted diagnosis.

Since 2009, we have prospectively investigated, clinically and biologically, 1216 consecutive EHS and/or MCS-self reporting cases, in an attempt to answer both questions. We report here our preliminary data, based on 727 evaluable of 839 enrolled cases: 521 (71.6%) were diagnosed with EHS, 52 (7.2%) with MCS, and 154 (21.2%) with both EHS and MCS. Two out of three patients with EHS and/or MCS were female; mean age (years) was 47. As inflammation appears to be a key process resulting from electromagnetic field (EMF) and/or chemical effects on tissues, and histamine release is potentially a major mediator of inflammation, we systematically measured histamine in the blood of patients. Near 40% had an increase in histaminemia (especially when both conditions were present), indicating a chronic inflammatory response can be detected in these patients. Oxidative stress is part of inflammation and is a key contributor to damage and response. Nitrotyrosin, a marker of both peroxynitrite (ONOO° -) production and opening of the blood-brain barrier (BBB), was increased in 28% of the cases. Protein S100B, another marker of BBB opening was increased in 15%. Circulating autoantibodies against O-myelin were detected in 23%, indicating EHS and MCS may be associated with autoimmune response. Confirming animal experiments showing the increase of Hsp27 and/or Hsp70 chaperone proteins under the influence of EMF, we found increased Hsp27 and/or Hsp70 in 33% of the patients. As most patients reported chronic insomnia and fatigue, we determined the 24 h urine 6-hydroxymelatonin sulfate (6-OHMS)/creatinin ratio and found it was decreased (<0.8) in all investigated cases. Finally, considering the self-reported symptoms of EHS and MCS, we serially measured the brain blood flow (BBF) in the temporal lobes of each case with pulsed cerebral ultrasound computed tomography. Both disorders were associated with hypoperfusion in the capsulothalamic area, suggesting that the inflammatory process involves the limbic system and the thalamus.

Our data strongly suggest that EHS and MCS can be objectively characterized and routinely diagnosed by commercially available simple tests. Both disorders appear to involve inflammation-related hyper-histaminemia, oxidative stress, autoimmune response, capsulothalamic hypoperfusion and BBB opening, and a deficit in melatonin metabolic availability; suggesting a risk of chronic neurodegenerative disease. Finally the common co-occurrence of EHS and MCS strongly suggests a common pathological mechanism.

Belyaev IY, Hillert L, Protopopova M, Tamm C, Malmgren LO, Persson BR, Selivanova G, Harms-Ringdahl M. 915 MHz microwaves and 50 Hz magnetic field affect chromatin conformation and 53BP1 foci in human lymphocytes from hypersensitive and healthy persons. Bioelectromagnetics. 26(3):173-184, 2005.

We used exposure to microwaves from a global system for mobile communication (GSM) mobile phone (915 MHz, specific absorption rate (SAR) 37 mW/kg) and power frequency magnetic field (50 Hz, 15 μT peak value) to investigate the response of lymphocytes from healthy subjects and from persons reporting hypersensitivity to electromagnetic field (EMF). The

Radiation Sickness; Electromagnetic hypersensitivity: evidence for a novel neurological syndrome. Int J Neurosci. (McCarty et al); 2011

Int J Neurosci. 2011 Dec;121(12):670-6. doi: 10.3109/00207454.2011.608139. Epub 2011 Sep 5.

Electromagnetic hypersensitivity: evidence for a novel neurological syndrome.

McCarty DE, Carrubba S, Chesson AL, Frilot C, Gonzalez-Toledo E, Marino AA.

Source

Department of Neurology, LSU Health Sciences Center, Shreveport, Louisiana 71130-3932, USA.

Abstract

OBJECTIVE:

We sought direct evidence that acute exposure to environmental-strength electromagnetic fields (EMFs) could induce somatic reactions (EMF hypersensitivity).

METHODS:

The subject, a female physician self-diagnosed with EMF hypersensitivity, was exposed to an average (over the head) 60-Hz electric field of 300 V/m (comparable with typical environmental-strength EMFs) during controlled provocation and behavioral studies.

RESULTS:

In a double-blinded EMF provocation procedure specifically designed to minimize unintentional sensory cues, the subject developed temporal pain, headache, muscle twitching, and skipped heartbeats within 100 s after initiation of EMF exposure ($p < .05$). The symptoms were caused primarily by field transitions (off-on, on-off) rather than the presence of the field, as assessed by comparing the frequency and severity of the effects of pulsed and continuous fields in relation to sham exposure. The subject had no conscious perception of the field as judged by her inability to report its presence more often than in the sham control.

DISCUSSION:

The subject demonstrated statistically reliable somatic reactions in response to exposure to subliminal EMFs under conditions that reasonably excluded a causative role for psychological processes.

CONCLUSION:

EMF hypersensitivity can occur as a bona fide environmentally inducible neurological syndrome.

Comment in

[Letter to the editor: electromagnetic hypersensitivity.](#) [Int J Neurosci. 2012]

Electromagnetic Hypersensitivity: Evidence for a Novel Neurological Syndrome

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ABSTRACT

Objective: We sought direct evidence that acute exposure to environmental-strength electromagnetic fields (EMFs) could induce somatic reactions (EMF hypersensitivity). **Methods:** The subject, a female physician self-diagnosed with EMF hypersensitivity, was exposed to an average (over the head) 60-Hz electric field of 300 V/m (comparable with typical environmental-strength EMFs) during controlled provocation and behavioral studies. **Results:** In a double-blinded EMF provocation procedure specifically designed to minimize unintentional sensory cues, the subject developed temporal pain, headache, muscle twitching, and skipped heartbeats within 100 s after initiation of EMF exposure ($p < .05$). The symptoms were caused primarily by field transitions (off-on, on-off) rather than the presence of the field, as assessed by comparing the frequency and severity of the effects of pulsed and continuous fields in relation to sham exposure. The subject had no conscious perception of the field as judged by her inability to report its presence more often than in the sham control. **Discussion:** The subject demonstrated statistically reliable somatic reactions in response to exposure to subliminal EMFs under conditions that reasonably excluded a causative role for psychological processes. **Conclusion:** EMF hypersensitivity can occur as a *bona fide* environmentally inducible neurological syndrome.

KEYWORDS: electromagnetic fields, evoked potentials, hypersensitivity, provocation study, sensory transduction, sleep study

INTRODUCTION

Man-made electromagnetic fields (EMFs) such as those produced by cell phones, powerlines, or computers are ubiquitous in the general and workplace environments. About 3%–5% of the population subjectively associates acute or subacute exposure to EMFs with departures from normal function or feeling (EMF hypersensitivity) (Levallois, Neutra, Lee, & Hristova, 2002; Schreier, Huss, & Rössli, 2006). The prevalence of self-reported EMF hypersensitivity has usually been attributed to somatization disorders (Rubin, Das Munshi, & Wessely, 2005; Rubin, Nieto-Hernandez, & Wessely, 2010).

A possible nonpsychological basis for EMF hypersensitivity was provided by the discovery of the abil-

ity of human beings to detect weak EMFs, as evidenced by the occurrence of field-onset and field-offset brain potentials (Carrubba, Frilot, Chesson, & Marino, 2007), and the induction of steady-state changes in brain electrical activity that persisted during the presence of the field (Marino, Carrubba, Frilot, Chesson, & Gonzalez-Toledo, 2010). The underlying mechanism of field sensory transduction appears to be an electric-force-sensitive ion channel (Marino, Carrubba, Frilot, & Chesson, 2009). Animal studies suggest that the electroreceptor cells and/or afferent processing cells are located in the brain stem (Frilot, Carrubba, & Marino, 2009, 2011).

Despite the physiological and biophysical evidence that could explain at least some cases of human somatic responses to EMFs without invoking psychological processes (Carrubba et al., 2007; Frilot et al., 2009, 2011; Marino et al., 2009, 2010), direct evidence of nonpsychological EMF hypersensitivity is lacking. Our purpose was to determine whether EMFs could

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produce symptomatic responses in a putatively hypersensitive subject while appropriately controlling for chance, confounders, and somatization.

METHODS

Subject

In the context of ongoing human, animal, and biophysical studies involving EMF sensory transduction in our laboratory, we were contacted by a 35-year-old female physician with multiple neurologic and somatic symptoms including headaches, hearing and visual disturbances, subjective sleep disturbances and non-restorative sleep, and musculoskeletal complaints, all of which she reported could be precipitated by exposure to environmental EMFs and abated by withdrawal from the fields. Among the environmental triggering sources she identified were cell phones, computers, powerlines, and various common electrical devices. During extensive interviews she credibly explained the reasons for her belief that EMFs from common environmental sources could provoke her symptoms.

After she agreed to medical tests appropriate for evaluating her medical condition, she was admitted as a patient on the neurology service and underwent a physical exam including a comprehensive neurologic exam, a clinical electroencephalogram (EEG) exam, a noncontrast magnetic resonance (MR) imaging of the brain, an overnight sleep study (with video and expanded EEG montage) in which the resulting polysomnogram was scored in accordance with standardized rules (American Academy of Sleep Medicine, 2007), a standard laboratory evaluation of serum electrolytes and blood chemistries, liver function tests, serum fasting cortisol, and complete blood count, and direct evaluations of her EMF sensitivity in a series of EMF provocation and behavioral studies (see below). The institutional review board at the LSU Health Sciences Center approved all experimental procedures, and the subject gave her written informed consent.

EMF Exposure

The subject sat in a comfortable wooden chair with her eyes closed, and uniaxial 60-Hz (unless noted otherwise) sinusoidal electric fields were generated by applying a voltage to parallel 49-cm square metal plates spaced 36 cm apart (Figure 1). The equipment that controlled the field was located outside the subject's view and emitted no visual or auditory stimuli. The background electric field (the field present irrespective of whether or not a voltage was applied to the parallel plates) was about 1 V/m throughout the region occupied by the subject (HI-

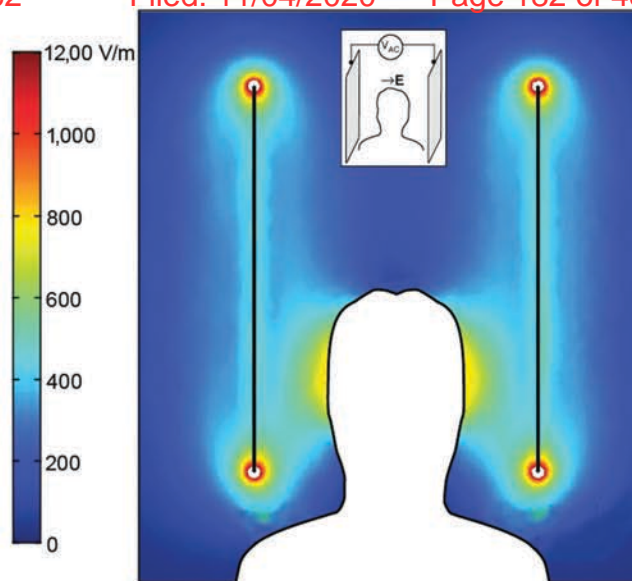


FIGURE 1. Spatial distribution of the external electric field (E) in the mid-sagittal plane. E was generated by applying $V_{AC} = 100$ volts to parallel metal plates while the subject was electrically isolated (insert), and calculated at all points in the subject's environment. Average E surrounding the head was about 300 V/m.

3603, Holaday, Eden Prairie, MN, USA). The plate arrangement did not produce magnetic fields. The continuously present background 60-Hz magnetic field was 0.1 mG, and the geomagnetic field was 599.8 mG, 68.4° below the horizontal component (component along the direction of the applied field, 360.5 mG) (MAG-03, Bartington, GMW, Redwood City, CA, USA). High-frequency signals from cell-phone towers and other distant antennae (1–10 GHz) were less than $0.1 \mu\text{W}/\text{cm}^2$ (the background fields in the sleep-study room were similar; (Spectran, Aaronia, Euscheid, Germany).

In the provocation studies the electric field was applied for 100-s intervals with a duty cycle of 50% and a repetition rate of 10 Hz, which resulted in alternating field-on and field-off pulses of 100 ms (pulsed field); a continuous field (100% duty cycle) was used in one of the provocation studies. Duty cycle, pulse structure, and interval length were regulated by a microcontroller programmed to produce the desired signals. When the duty cycle was 50%, the actual EMF stimuli consisted of (1) 10 onset stimuli per second $\times 100 \text{ s} = 1,000$ field-onset stimuli per interval; (2) an equal number of field-offset stimuli; and (3) the presence of the EMF for a total of 50 s. When the duty cycle was 100%, there was only one field-onset stimulus and one field-offset stimulus, and the EMF was present for 100 s. In the behavioral studies, the electric field was applied in trials consisting of a 2-s epoch when a pulsed field was applied (50%

USCA Case #20-1138 Document #1869762
 duty cycle, 10-Hz repetition rate) and a 10-s field-free control epoch.

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Field Strength

The applied electric field was significantly distorted by the subject's body, resulting in strong inhomogeneities in the field surrounding the subject. To overcome the problem of measuring the external field, we used Maxwell's laws to calculate it at every point in the subject's vicinity. The subject was modeled as an electrically isolated composite of rectangular solids representing the trunk and lower extremities and an ellipsoid representing the head. The assumed conductivity was 1 S/m. The total electric field at every point was determined for $V_{AC} = 100$ V using finite-element analysis consisting of approximately 10^6 elements; a more detailed mesh was automatically generated in the head region (Multiphysics, Comsol, Los Angeles, CA, USA). The peak external electric field was about 1,000 V/m (see Figure 1); the average field was about 300 V/m around the head and less than 50 V/m around the body. The peak and average field strength and duration of exposure were far below the levels generally recognized as capable of producing physiological effects in human subjects (International Commission on Non-Ionizing Radiation Protection, 1998).

The external electric field resulted in an induced internal electric field in the brain in accordance with physical law. The strength of the induced brain electric field was comparable with that induced by environmental-strength power-frequency electric and magnetic fields (Carrubba, Frilot, Chesson, & Marino, 2010; Carrubba, Frilot, Hart, Chesson, & Marino, 2009).

Somatic Responses

A pulsed field (50% duty cycle) was applied for 100 s in 10 independent field-exposure intervals. The controls were ten 100-s sham-exposure intervals during which a field was not applied. The order of the field and sham intervals was determined randomly. The environmental conditions during the field-exposure and sham-exposure intervals were identical except that the wires carrying the plate voltage were disconnected during the sham-exposure intervals. At the end of each interval the subject was questioned by an interviewer blinded to whether or not the field had been applied and asked to describe any symptoms she developed during the interval, whether or not the symptoms had persisted into the interview period. She was queried using descriptive terms she had employed. Whenever she reported symptoms, commencement of the next interval was delayed until she reported that they had abated.

We used a pulsed field because we expected it would result in a stronger symptomatic response compared with a continuous field (Carrubba, Frilot, Chesson, & Marino, 2008; Frilot et al., 2011). To test this reasoning, we performed a second study to assess whether the subject developed a differential symptomatic response to the pulsed and continuous fields. The subject was exposed or sham exposed for 100-s intervals and immediately after each interval was interviewed as described above. A sham (S) field, continuous (C) field (100% duty cycle), and pulsed (P) field (50% duty cycle, 10 Hz) were applied, and the SCP pattern was repeated five times. The subject was blinded regarding the use of different EMFs; from her perspective, the laboratory procedures were identical to those followed in the first study. The interviewer was aware that the effects of C and P fields were being compared but was blinded regarding the actual sequence of the fields.

Behavioral Responses

We considered the possibility that any symptomatic response might be a result of the combined processes of conscious awareness of the EMF followed by a somatization reaction based on a fear that EMFs were harmful. We approached the issue by determining whether the subject could consciously perceive a field when it was presented in multiple independent trials. A field having the same strength and spatial distribution as previously (Figure 1) was applied in a series of trials each of which consisted of a 2-s epoch during which a pulsed field (50% duty cycle, 10-Hz repetition rate) was applied and a 10-s field-free control epoch. Eight independent sequences were employed, each with 30–50 trials. In three sequences, the frequency was 60 Hz; in two, it was 1 kHz; and in three others, the respective frequencies were 10, 100, and 500 kHz.

The subject held a small plastic box that housed a buzzer, a button labeled YES and another button labeled NO. In the middle of each on and off epoch the buzzer emitted a 4-kHz tone at 60 dB that lasted 100 ms, and she was instructed to press the YES or NO button whenever she heard the tone, depending on whether or not she had any conscious sensation of a field at that moment. Employing a custom-designed virtual instrument (LabView, National Instruments, Austin, TX, USA), we determined the number of YES and NO responses in the presence and absence of the field in each sequence. In addition, four sham sequences (minimum of 30 trials in each) were conducted in which a field was not applied. The subject had no knowledge that an off-on pattern was being used in the field sequences or that some sequences consisted of sham exposure.

TABLE 1. Polysomnography results. Comparison with usual night, per patient: "Same as usual." No epileptiform activity noted during arousals associated with unintended gross motor activity. Normal REM-related atonia

Subject		Normal range
Sleep latency	6 min	13.4 ± 10.1 (Hirshkowitz, Moore, Hamilton, Rando, & Karacan, 1992)
Stage N1 sleep	13.8%	3%–8% (Chokroverty, Thomas, & Bhatt, 2005)
Stage N2 sleep	51.8%	44%–55% (Chokroverty et al., 2005)
Stage N3 sleep	23.6%	10%–15% (Chokroverty et al., 2005)
Stage R sleep	10.7%	20%–25% (Chokroverty et al., 2005)
REM latency	150.5 min	57%–66 min (Pressman, 2002)
WASO index	6/hr	1.3 ± 0.8 (Hirshkowitz et al., 1992)
WASO total	40.5 min	10.7 ± 11 min (Naifeh, Severinghaus, & Kamiya, 1987)
Total sleep time	340.5 min	340.0 ± 70 (Hirshkowitz et al., 1992)
Sleep efficiency	88%	86.4% ± 11.6% (Hirshkowitz et al., 1992)
Arousal index	34.2/hr	16.8 ± 6.2 (Bonnet & Arand, 2007)
PLM index	7.8/hr	< 5/hr (Nicolas, Michaud, Lavigne, & Montplaisir, 1999)
AH index	0.2/hr	< 5/hr (American Academy of Sleep Medicine, 2005)

Note: REM, rapid eye movement; WASO, wake after sleep onset; PLM, periodic limb movement; AH, apnea/hypopnea.

Statistics

The frequencies of the somatic and behavioral responses in the presence and absence of the field were evaluated using the chi-square test (2×2 tables) or the Freeman–Halton extension of the Fisher exact probability test (2×3 tables; Freeman & Halton, 1951).

RESULTS

Clinical Studies

The patient's physical examination was unremarkable. The presence of frequent subjective awakenings from sleep, sometimes with unintended gross motor activity such as muscle twitching and leg jerking, prompted clinical concern for a sleep-related movement disorder, parasomnia, or nocturnal epilepsy. The polysomnogram revealed significant sleep fragmentation and discontinuity (Table 1) but no evidence of significant sleep-disordered breathing, nocturnal epilepsy, or abnormal rapid-eye-movement-related (REM-related) atonia. Periodic limb movements were noted but did not appear to be a major sleep-disrupting force.

Standard and 24-hr video-accompanied EEG recordings revealed normal-appearing background rhythms and no epileptiform activity. EEG performed in the presence of active cellular telephone use provoked a right-sided headache, but produced no unusual EEG waveforms. The MR image revealed evidence of cortical dysplasia in the right temporal lobe, and right parietal polygyria, both without interval change when compared with a study performed 19 months earlier. Laboratory evaluation for common metabolic/endocrine problems and blood count abnormalities was unremarkable.

Somatic Responses

The sequence and characteristics of the symptomological and behavioral experiments are shown in Table 2.

The question of a relation between the presence of the field and the occurrence of symptoms was directly addressed by interviewing the subject immediately following 100-s field-exposure or sham-exposure intervals; both the interviewer and the subject were blinded regarding the exposure condition. During the interviews, the subject reported a range of symptoms including localized pain in her jaw, ear, or the side of her head, a more diffuse head pain, and muscle pain or twitching in the hip, neck, and back. Sometimes she qualified the symptom as "strong" or "mild," and sometimes she denied all symptoms. We grouped the symptoms related to localized head pain as "temporal pain," those related to diffuse head pain as "headache," and those related to muscle effects as "muscle pain/twitching." Symptoms reported more rarely were indicated explicitly (see Table 3a). The subject consistently reported pronounced symptoms that occurred during the field intervals, particularly in intervals 7, 13, 14, 15, and 18. In the sham intervals, she reported no symptoms in intervals 4, 6, 8, 16, and 20; weak temporal pain in intervals 2, 3, and

TABLE 2. Sequence and characteristics of experiments

Experiment	Electric field		Trial	
	Condition	No. of trials	Duration (sec)	Response
1	Pulsed	10	100	Symptoms
	Sham	10	100	
2	Pulsed	5	100	Symptoms
	Continuous	5	100	
3	Sham	5	100	Behavior
	Pulsed	300	1	
	Sham	150	1	

TABLE 3. Evaluation of the relation between presentation of a pulsed electric field and the development of symptoms. (a) Results from the individual 100-s exposure intervals. (b) Summary table

(a)	Interval no.	Condition	Result
	1	Pulsed field	Temporal pain
	2	Sham	Mild temporal pain
	3	Sham	Mild temporal pain
	4	Sham	No symptoms
	5	Pulsed field	Temporal pain; headache
	6	Sham	No symptoms
	7	Pulsed field	Skipped heartbeats; feeling unease
	8	Sham	No symptoms
	9	Pulsed field	Headache
	10	Sham	Mild headache
	11	Pulsed field	Temporal pain
	12	Sham	Mild headache
	13	Pulsed field	Muscle twitch; feeling unease
	14	Pulsed field	Strong headache
	15	Pulsed field	Strong headache
	16	Sham	No symptoms
	17	Pulsed field	Stiff neck
	18	Pulsed field	Muscle twitch; temporal pain
	19	Sham	Mild temporal pain
	20	Sham	No symptoms

Symptoms			
(b)	Field condition	None	Mild ≥ Mild
	Sham	5	5 0
	Pulsed field*	0	0 10

* $p < .05$.

19; and a weak headache in intervals 10 and 12. The field and sham distributions of symptoms differed significantly ($p < .05$; see Table 3b).

In a second study, the relative role of EMF changes (number of onsets and offsets) and steady-state presence of the EMF were directly addressed by interviewing the subject immediately following 100-s exposure intervals in which either a pulsed field or a continuous field was presented. She was queried regarding her symptoms as previously and reported symptoms in both field intervals (see Table 4a). The symptoms triggered by the pulsed field were more intense compared with the sham control ($p < .05$; see Table 4b); the symptoms triggered by the continuous field did not differ from the sham control ($p = .16$). The subject reported no symptoms in four of five sham intervals (intervals 1, 4, 10, 13).

TABLE 4. Evaluation of the comparative effect of continuous and pulsed fields relative to a sham field on the development of symptoms. (a) Results from individual 100-s exposure intervals. (b) Summary table

(a)	Interval no.	Condition	Result
	1	Sham	No symptoms
	2	Continuous field	No symptoms
	3	Pulsed field	Temporal pain
	4	Sham	No symptoms
	5	Continuous field	No symptoms
	6	Pulsed field	Mild headache
	7	Sham	Mild headache
	8	Continuous field	Muscle twitch
	9	Pulsed field	Severe pain
	10	Sham	No symptoms
	11	Continuous field	Temporal pain
	12	Pulsed field	Headache; muscle twitch
	13	Sham	No symptoms
	14	Continuous field	Mild temporal pain
	15	Pulsed field	Mild temporal pain

Symptoms			
(b)	Condition	None	Mild ≥ Mild
	Sham	4	1 0
	Continuous field	2	0 3
	*Pulsed field	0	2 3

* $p < .05$.

Behavioral Responses

The possible influence of conscious awareness of the EMF on the development of symptoms was investigated by assessing whether the subject could consciously perceive the field. A total of 300 independent trials involving carrier frequencies of 60 Hz to 500 kHz were used; the controls consisted of 150 sham trials. The results did not depend on the carrier frequency, and consequently the data were combined for analysis (see Table 5).

The subject failed to respond to the tone seven times while the field was on and seven times while it was off, resulting in a total of 293 responses for each of the two conditions. There were no missed responses in the sham trials. The overall YES response rate in the field trials was $(51/586) \times 100 = 8.7\%$. The occurrence of a YES response was significantly associated with the presence of the field ($p < .05$; see Table 5a), but the sensitivity of the YES responses was low $([32/(32 + 261)] \times 100 = 11\%)$. The YES response rate in the sham trials was slightly higher than that seen in the field trials $([27/273 = 9.9\%])$ (see Table 5b).

Table 5. Evaluation of conscious perception of a pulsed electric field. The subject's responses during the presence (on) and absence (off) of the field, respectively

(a)	Response	Pulsed field	
		On	Off
	Yes*	32	19
	No	261	274
(b)	Response	Sham	
		On	Off
	Yes	15	12
	No	135	138

* $p < .05$.

DISCUSSION

Appropriately controlled provocation studies are required to establish the existence of EMF hypersensitivity and to understand the relative importance of psychological and nonpsychological processes in mediating any observed symptoms. A working laboratory definition of EMF hypersensitivity formulated in symptomological terms is therefore needed to permit recognition of hypersensitivity reactions when they occur. In previous provocation studies, the assumption was made that true hypersensitive subjects would exhibit more or less the same symptoms in response to repeated provocations. The assumption led to experimental designs that involved averaging across exposed and control groups, which is an inherently insensitive statistical procedure for detecting real but variable responses (Rubin *et al.*, 2005, 2010). The assumption is particularly inapplicable to EMF hypersensitivity because intrasubject and intersubject variabilities are its salient features (Levallois *et al.*, 2002; Schreier *et al.*, 2006). We defined EMF hypersensitivity as the occurrence of any medically recognized symptom in response to provocation using an environmentally relevant EMF; there was no requirement that the same symptom must reoccur when the EMF provocation was repeated. This definition avoided the problem of masking real effects and more appropriately matched the laboratory procedure to the known characteristics of EMF hypersensitivity (Levallois *et al.*, 2002; Schreier *et al.*, 2006). We focused on a single self-reported subject and employed a procedure in which she served as her own control. While controlling for artifacts, chance, and somatization, the question whether she reliably exhibited *any* symptomatic responses to an EMF was addressed; the alternative hypothesis was that she did not exhibit EMF-triggered symptoms. The laboratory conditions were controlled in such a way that

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a putative role of psychological processes could reasonably be identified.

The subject developed symptoms in association with the presentation of a pulsed electric field significantly ($p < .05$) more often than could reasonably be explained on the basis of chance (see Table 3). Several considerations suggested that the statistical link was a true causal association with a subliminal EMF. First, the subject's environment was carefully controlled to avoid putative confounding factors. The testing took place in an acoustically quiet environment, and the presence of uncontrolled environmental EMFs was nil. The environmental conditions during the field-exposure and sham-exposure intervals were identical except that during the sham-exposure intervals, at a point far removed from the subject's field of view, the wires carrying the plate voltage were disconnected. A key aspect of our laboratory procedure was the elimination of sensory cues that could serve as conscious markers of the electric field leading to a somatization reaction. All appropriate precautions were taken to eliminate potential confounders. Second, the occurrence of symptoms was significantly associated with the type of EMF (see Table 4). The symptomatic response was associated with the pulsed EMF, which maximized occurrence of the number of transient changes in the EMF (off-on and on-off), not with the presence of the field, as expected on the basis of prior animal studies where the issue of somatization was irrelevant (Frilot *et al.*, 2011). Finally, in a behavioral study specifically designed to assess awareness of the field, YES response rates were 8.7% and 9.9% in the field and sham conditions, respectively, which provided no evidence for a psychological role in the development of the subject's symptoms. We therefore conclude with a reasonable level of certainty that the causal association we found between the presence of the EMF and the subject's symptoms was mediated by a subconscious neural process. Although chance was an unlikely explanation for the association, that possibility could not be excluded. The existence of the neurological syndrome reported here was previously suspected but not documented.

The mechanism for the subject's symptoms of headache, visual disturbances, and somatic musculoskeletal discomfort following exposure to EMFs is unknown. On the basis of clinical evaluation, intermittent seizure activity is not a credible explanation, although a deeper epileptic focus with partial seizure activity may have escaped the detection of surface EEG electrodes. The abnormal findings in the subject's medical workup included the abnormal MR image (cortical dysplasia and polygyric changes) and extensive sleep discontinuity and fragmentation manifested in the overnight polysomnogram; the possible association of these

findings with the subject's syndrome of EMF hypersensitivity is unknown.

Our aim here was to concentrate on the previously unaddressed question whether acute exposure to weak EMF could produce real but not precisely predictable somatic effects mediated by nonpsychological processes. Within the limitations of the study, we concluded that we demonstrated the neurological syndrome in the subject we studied. The question of whether EMF hypersensitivity is a significant public-health problem was not addressed here. The EMF we employed was equivalent in strength and pulse structure to EMFs pervasively present in the environment (Levallois et al., 2002; Schreier et al., 2006), and our results were consistent with the possibility that environmental EMFs can directly trigger clinical symptoms. Nevertheless resolution of the public-health issue depends on a deeper understanding of how internal EMFs caused by environmental EMFs are related to physiological process and of the role of psychological factors and comorbidities in the exposed population in exacerbating the processes resulting in disease.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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Radiation Sickness - Children; Dr. Torill Jelter MD. (Petitioner)
Comments, Nov. 17, 2013

Toril H. Jelter, M.D. FAAP
M.D. I. Wellness Center
325 North Wiget Lane
Walnut Creek, CA 94598

Sept. 2, 2013

Re: The reassessment of FCC radio frequency exposure limits and policies

Dear FCC:

I am writing to you today to request that you reevaluate current FCC safety standards for wireless technologies and “dirty” electricity. The reason I am requesting this is because current research and what I see in my clinical practice indicate a revision of current safety standards is long overdue.

Children are suffering disability and disease in much higher numbers than 30 years ago. Their EMF exposure is clearly a significant contributing factor. The fastest, most reliable way of educating yourselves on this topic is to read and understand the Bioinitiative Reports of 2007 and the 2012 update. Table 1-1 “Summary for the public” would be a good starting point.

1. Children have a right to live and play and learn where their DNA will not be damaged by non-ionizing radiation. This is not the case today. See sections 5 and 6 of the 2012 Bioinitiative Report for evidence for effects on genes and protein expression and genotoxic effects – RFR and ELF DNA damage with current “safety standards.”
2. Children have a right to live and play and learn in locations where their immune systems are adequately protected from detrimental non-ionizing radiation. This is not the case today. See Section 8 of the 2012 Bioinitiative Report “Evidence for effects on immune function.” Children are developing allergies and cancer at much higher rates than before.
3. Children have a right to live and play and learn where non-ionizing radiation will not adversely affect their neurology or behavior. This is not the case today. See Section 9 of the 2012 Bioinitiative Report “Evidence for effects on neurology and behavior”

CASE HISTORY

A four-year-old boy presents to my office with his parents. They request help for their son so he may be able to learn and behave better. He moves around my waiting room like a hurricane, turning over chairs, pulling at the blinds, damaging the blinds, and screaming. His parents look on with their shoulders drooping and their hands in their pockets. They love their son dearly but he is so out of control they have no clue where to begin. We agree on a two-week EMF remediation trial (no Wi-Fi for 12 hours at night, no cordless phones, and Stetzer filters to decrease detrimental EMF from house wiring). Within one week I received an email from his parents. “The EMF remediation trial is working. Our son is now able to have more back and forth conversation. We have better eye contact with him and he is even receptive to the idea of a star chart for good behavior. In addition his bowel movements are now normal.”

At follow-up in my office, which now had RF filters throughout, this child was calm, poised, made good eye contact and could converse at age level. His “bad” behaviors were gone.

CASE HISTORY

A five-year-old boy presents with parents who tell me their child has uncontrollable arm flapping daily and has been diagnosed with an Autism Spectrum Disorder. They disagree with the

diagnosis because when he visits grandma in rural Tennessee for a month, the arm flapping stops completely! When they return to the San Francisco Bay Area the arm flapping returns. The parents also mention that there is no cell-phone reception in grandma's area of Tennessee.

CASE HISTORY

A three-year-old child is being evaluated for speech delay and learning disability. He also has frequent high-pitched screaming and head-bangs and rocks a lot and has great sleep difficulties. But when he visits his aunt in rural Oregon (where there is no cell-phone reception) he sleeps for the first 24 hours and then wakes up like a "new child."

He no longer screams, he is calm, he plays normally, he can sleep at night and be awake during the day. When the family returns to their home in California, their son has high-pitched screaming again when they reach the Sacramento area, and his sleep difficulties and other problems return.

4. Children have a right to live, play and learn in locations that protect them from developing cancer at a young age. This is not the case today.

CASE HISTORY

A 12-year-old girl presents with her dad. She is diagnosed with liver cancer. Six months later, shortly after her 13th birthday, she succumbs.

CASE HISTORY

A five-year-old girl develops a severe headache. She takes the ice cream from the grocery cart and puts it against her head for relief. She has a brain tumor. She spends the next year in and out of the hospital. Finally, she has an uncontrollable seizure and dies.

CASE HISTORY

A two-week-old child is diagnosed with cancer. He spends the rest of his life in and out of the hospital. At age five he says to his mother "I can't do this any more." That night, he breathes his last breath.

See section 11 and 12 of the 2012 Bioinitiative Report for evidence of brain tumors and acoustic neuromas and childhood cancers (leukemia.)

5. Children have a right to a good night's sleep.

See the Bioinitiative Report section 13. Evidence for effects of low-intensity electromagnetic radiation on melatonin (the sleep hormone.)

CASE HISTORY

A four-year-old boy presents with his parents with a complaint of sleep difficulties. He hasn't slept for two years and climbs in his parents' bed every night, so they also have had poor sleep for two years and are exhausted.

The evening before they came to see me, they gave their son some melatonin and it seemed to help. Knowing that EMF can lower melatonin, I suggested a two-week EMF remediation trial. (No Wi-Fi 12 hours at night, no cordless phone, and Stetzer filters to lower extremely low frequency EMF.)

They followed my EMF remediation instructions and stopped the melatonin supplement. Within a few days the son and the parents were sleeping fine without a melatonin supplement.

6. Children have a right to live, play and learn in locations that permit them to retain their fertility so that they may reproduce when they become adults. That is not the case today. Most schools have Wi-Fi and more. Young girls place laptops on their laps where non-ionizing radiation from the laptop can damage their future offspring as all their eggs are mere inches from the laptop.

See section 18 of the 2012 Bioinitiative Report. Fertility and reproduction- effects of EMF.

7. Children have a right to live play and learn in locations that permit them to grow up and have the ability to reproduce and have healthy children.

CASE HISTORY

A young woman with excellent health and good pre-natal care gives birth to a boy with a heart defect. No previous relatives on either side had a heart defect. During her pregnancy, she lived in a building across the street from a power substation. The light bulbs burst frequently in her apartment and needed to be replaced often. This is a sign of too much dirty electricity in the home. Too much dirty electricity (ELF) contributes to birth defects.

See section 19 of the 2012 Bioinitiative Report. Fetal and neonatal effects of EMF.

8. Children have a right to live, play and learn in a location that permits them the ability to speak.

CASE HISTORY

A 12-year-old boy comes to my office with his parents, who are asking for help with his aggressive behavior. He has also been diagnosed with autism and is unable to speak (non-verbal). They agree to a two-week EMF remediation trial. Within three days this young man said a complete sentence much to the disbelief of his mother and himself! His aggressive behaviors disappeared.

See section 20 of the Bioinitiative Report. "Findings in autism consistent with EMF and RFR"

Over 1% of America's children now have autism. And the numbers continue to rise. In addition to the pain and suffering these children and families experience, this problem alone threatens to bankrupt whole school systems at a time when we can least afford it.

When I as a physician need to perform a potentially dangerous procedure on a child, such as a spinal tap, I need to explain why it is necessary and what the risks are. Then I need to get written consent from the parents and the parents have the right to refuse.

Currently, we are performing large-scale experiments on America's children without informing children or their parents of the risk. Children and their parents have not given their consent nor have they been given an option to opt out.

See section 2, 3 and 4 of the 2012 Bioinitiative Report. "Statement of the problem, the existing public exposure standards and evidence for inadequacy of current standards."

A nation that does not protect its children has no future. Please reevaluate the FCC Safety Guidelines for non-ionizing radiation.

America's children have the right to sleep, speak, behave, learn and – as adults – to reproduce. Please don't take these from them. Please help America's children and America to have a future. Thank you for your time.

Sincerely,

Toril H. Jelter M.D. FAAP

P.S. – All case histories are real patients, minor details have been omitted or changed to ensure privacy.

Radiation Sickness, Deborah Kopald Comments, Jul. 13, 2016

FCC Proceedings 14-177, 15-256, 10-112, and 97-95
Comment of Deborah Kopald
July 13, 2016

The FCC should put an immediate moratorium on the rollout of 5G or indeed any more transmitter infrastructure. What is needed now is a national accounting of the health effects of the excess level of second-hand and first-hand radiation with which the FCC is permitting people to saturate the entire indoor environment and increasingly the outdoor environment. The levels in many areas of major cities and most of the indoor building environment are already correlated with biological dysfunction that causes cancer, neurotransmitter disease and infertility among other serious diseases. This has been documented by a number of prominent scientists, including but not limited to Dr. David O. Carpenter of the Presidential Cancer Panel, who stated to a Federal Court that

“Chronic exposure to PM MW [Pulse-Modulated Microwave Radiation] radiation harms every individual in a population in some ways, even if these are not always detectable by the individual or consciously attributed to the responsible RF/MW radiation sources. This Agent injures some individuals into a condition in which symptoms will be more easily retriggered with subsequent exposure. And for a priori susceptible individuals and those using electronic medical devices, it can respectively exacerbate the extant medical conditions and disrupt medical device operation, even to the point of death.”¹

The general interest and willingness of government and even the public to address future risks is inversely proportional to the perception of the agent as a “convenience”.

Notwithstanding this dynamic, it is not optional to fail to address the imminent biological dysfunction that members of our population are experiencing from excess levels of radiation in public (and private spaces). While there is a population that has electro-hypersensitivity (EHS) that independent studies have documented as ranging from 1.5% to 13.3% of the population, there is evidence that levels of radiation in a Wi-Fi'ed environment, from too close proximity to a cell tower and increasingly around cell phones and wireless wearables that are sensitizing irritants also exacerbate many medical conditions and are especially dangerous for pregnant women, children and the elderly.² Furthermore, it appears that a double digit percentage of the people reacts with some symptoms of sensitization to this radiation with blood pressure³ and heart rate changes⁴ and/or that have brainwave changes that manifest as cognitive dysfunction

¹ Amended Declaration of Dr. David O. Carpenter, *AHM and David Mark Morrison v. Portland Public Schools* <http://www.magdahavas.com/wordpress/wp-content/uploads/2012/01/Amended-Declaration-of-Dr-David-Carpenter.pdf>, page 23.

² Baby Safe Project News Conference, Environmental Health Trust and Grassroots Environmental Education <http://www.babysafeproject.org/news-conference/>

³ Braune S. et al. Resting blood pressure increase during exposure to a radio-frequency electromagnetic field. *Lancet*: 1998; 351: 1857-1858.

⁴ Havas, M. Marongelle J. et al. Provocation study using heart rate variability shows microwave radiation from DECT phone affects autonomic nervous system. *European Journal of Oncology*, 2010, 273-300. <http://www.magdahavas.com/wordpress/wp-content/uploads/2010/10/Havas-HRV-Ramazzini1.pdf>

and/or sleep disorders⁵ as a result of Wi-Fi and/or passive transmitter radiation in cities or other areas with too many transmitters in the vicinity or on the premises.

This biological dysfunction needs to be addressed by having indoor transmitters turned off when requested in order to facilitate compliance with the Americans with Disabilities Act (ADA) or by finding alternate locations away from cell transmitters and fixed hotspots and/or by shielding indoor locations from the external sources when necessary and by having white zones free of this radiation in public places. 5G with its concomitant radiation increases should not be rolled out when there is evidence that proximity to such sources causes severe biological effects and that chronic exposure from existing radiation levels are responsible for public health problems and increased disease risk. The oft-stated purpose of 5G is to be able to download a movie onto a device within seconds. This is an illegitimate goal when weighed against these costs which include the violation of the civil rights of those who are particularly intolerant to this radiation.

The New York affiliate of CBS News reported in May 2015 that 5% of the population is now intolerant to Wi-Fi and related exposures. The State of California's Department of Health Services found in 2001 (published in 2002)⁶ that 3% of the population is sensitive to Electromagnetic Fields ("EMFs")⁷; the EU stated in a 2012 resolution that the problem is growing "exponentially"⁸, cites a 3-5% number and has expressed that White Zones (shut off of Wi-Fi, etc.) are necessary in public places so that the human rights of the statistically significant numbers of people with EHS are not violated. In 2015, the Canadian Parliament's Standing Committee on Health expressed that accommodation is required for people with EHS under the Canadian Human Rights Act⁹. In Sweden, a country where on information and belief 1/8 people work for Ericsson, a wireless company, 5% of the population is signed up with the Swedish EHS Association. The problem is out in the open there; that is to say that the public is largely aware of it and the government assists people who get symptoms from too close proximity to Wi-Fi, cell towers etc.; people with EHS can call up a municipal officer to get transmitters shut off

⁵ Redmayne M and Johansson O. Radiofrequency exposure in young and old: different sensitivities in light of age-relevant natural differences. *Rev Environ Health* 2015; 30(4): 323-335

⁶ Levallois P, Neutra R, Lee G, Hristova L. Study of self-reported hypersensitivity to electromagnetic fields in California. *Environ Health Perspect* 2002;110 (Suppl. 4):619-23.

⁷ Electromagnetic Fields (EMFs) are packets of energy that constitute radiation of varying frequencies that include extra-low frequency (ELF) fields of the type emanating from high tension electric power lines and even modern appliances; radio waves, including manufactured pulse-modulated microwaves (RF) which are emitted by modern-day wireless devices and transmitters (e.g. Wi-Fi, cell towers, cell phones, smart meters, Bluetooth) ; as well as X-rays (harnessed for medical imaging) and gamma rays (used to kill cancer cells in radiation therapy).

⁸ European Parliament Written declaration on the recognition of multiple chemical sensitivity and electrohypersensitivity in the International Statistical Classification of Diseases and Related Health Problems (ICD), 3/12/12, <http://www.europarl.europa.eu/sides/getDoc.do?type=WDECL&reference=P7-DCL-2012-0014&format=PDF&language=EN>, page 2.

⁹ Radiofrequency Electromagnetic Radiation and the Health of Canadians, Report of the Standing Committee on Health, June 2015: <http://www.parl.gc.ca/HousePublications/Publication.aspx?DocId=8041315&Language=E&Mode=1&Parl=41&Ses=2>

when they need to access an institution. The Stockholm municipality provides shielded apartments and cottages in the countryside for those who are hypersensitive to this radiation. Switzerland also provides apartments without Wi-Fi away from cell towers and provided all of its citizens a comprehensive report that details what the sources of electromagnetic radiation are, explains how to reduce exposure and acknowledges that biological effects occur well below international limits¹⁰. Also, the German Federal Office of Radiation Protection had recommended in 2007 that people use hard-wired connections instead of Wi-Fi and lower their exposure to sources of electromagnetic radiation.

Severe electromagnetic sensitivities are recognized to exist by the Access Board, by the Social Security Administration, by courts in the 10th (Firstenberg v. City of Santa Fe, N.M., 696 F.3d 1018 (10th Cir. 2012)) and 11th Circuit (*Metallo v. Orlando Utilities Commission*, 6:14-cv-1975-Orl-40KRS) and by California Superior Court (*Joshua Hart v. Plumas Sierra Rural Electric*, Plumas County Superior Court, Case # SC SC15-Q0003). The Access Board states:

The Board Recognizes that multiple chemical sensitivities and electromagnetic sensitivities may be considered disabilities under the ADA if they so severely impair the neurological, respiratory or other functions of an individual that it substantially limits life activities.¹¹

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) an organization staffed with people who take a paycheck from industry, stated in 2002:

Different groups in a population may have differences in their ability to tolerate a particular NIR (non-ionizing radiation) exposure. For example, children, the elderly, and some chronically ill people might have a lower tolerance for one or more forms of NIR exposure than the rest of the population. Under such circumstances, it may be useful or necessary to develop separate guideline levels for different groups within the general population, but it may be more effective to adjust guidelines for the general population to include such groups.

Some guidelines may still not provide adequate protection for certain sensitive individuals nor for normal individuals exposed concomitantly to other agents, which may exacerbate the effect of the NIR exposure....Where such situations have been identified, appropriate specific advice should be developed within the context of scientific knowledge.¹²

In other words, ICNIRP effectively acknowledged the existence of a population sensitive to non-ionizing radiation. The “appropriate specific advice” has been developed and offered by the Access Board in conjunction with the National Institute of Buildings Sciences which indicates that hardwiring should be used instead of Wi-Fi, and if Wi-Fi is used, it should be confined by

¹⁰ “Electrosmog in the Environment”, Swiss Agency for the Environment, Forests and Landscapes, June 2005 <http://citizensforsafetechnology.org/uploads/scribd/Electrosmog%20in%20the%20Environment.pdf>

¹¹ Federal Register/ Vol. 67, No. 170/ Tuesday, September 3, 2002/ Rules and Regulations, 36 CFR Part 1191 [Docket No. 98-5] RIN 3014-AA16 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Recreation Facilities; **Action:** Final Rule, Page 56353.)

¹² International Commission on Non-Ionizing Radiation Protection, ICNIRP Statement: General Approach to Protection Against Non-ionizing Radiation: *Health Physics* 82(4):540-548; 2002.

foil-backed drywall, not spilling out uncontained within the entire premises.¹³ This report also acknowledges the external benefits to the whole population, not just those who need ADA accommodation: “Measures taken to improve indoor environmental quality, such as reducing air pollutants, noise and electromagnetic fields in buildings, will increase their accessibility for people with asthma and chemical and/or electromagnetic sensitivities, as well as provide a more healthful environment for all building occupants¹⁴.” and “By making indoor environments that are safer for the most vulnerable among us, we can create indoor environments that are healthier for everyone, especially children.¹⁵”

The larger problem and risk to all building occupants was noted by Swisscom, which was issued an international patent for a device that reduces Wi-Fi emissions (The Reduction of Electromog in Wireless Local Networks) in which the corporation explicitly acknowledged that Wi-Fi in offices along with other sources of pulse-modulated microwaves and radiofrequency radiation is dangerous to humans at levels below heating thresholds (below international guidelines) in that it is carcinogenic, genotoxic and stress-inducing:

The influence of electromog on the human body is a known problem.

....These findings indicate that the genotoxic effect of electromagnetic radiation is elicited via a non-thermal pathway. Moreover aneuploidy is to be considered as a known phenomenon in the increase of cancer risk.

Thus it has been possible to show that mobile radio radiation can cause damage to genetic material, in particular in human white blood cells, whereby both the DNA itself is damaged and the number of chromosomes changed. This mutation can consequently lead to increased cancer risk.

.... Despite increasingly strict national guidelines with respect to legally specified limits, the impact of electromog in WLANs on the human body can be considerable. Moreover it is to be expected that this impact will continue to increase in the future for many people.

....This means that even when the WLAN is not being used at all, an underlying stress from electromagnetic radiation remains for persons in the Basic Service Area of an access point of the WLAN. For example, in the case of WLANs at places of employment, such as offices, etc., there exists therefore permanent stress from electromog from the WLAN on the employees of the company or organization.¹⁶

¹³ United States Access Board/National Institute of Building Sciences Indoor Environmental Quality Report, 2005 http://web.archive.org/web/20060714175343/ieq.nibs.org/ieq_project.pdf, pages 87-88.

¹⁴ Ibid., page 8.

¹⁵ Ibid, page 87.

¹⁶ World Intellectual Property Organization REDUCTION OF ELECTROSMOG IN WIRELESS LOCAL NETWORKS, International Publication Number WO 2004/075583 A1 http://www.safeschool.ca/uploads/WiFi_Swisscom_Patent.pdf

So, the industry is acknowledging a problem with Wi-Fi and saying its deleterious effects have been proven and that the influence of electrosmog on the body is a “known problem”, while the FCC promotes further rollout of the infrastructure in question.

Furthermore, the World Health Organization (WHO) made the following statements in 1981::

General population exposure from man-made sources of microwave and RF radiation now exceeds that from natural sources by many orders of magnitude. The rapid proliferation of such sources and the substantial increase in radiation levels is likely to produce “electromagnetic pollution”. Man-made sources include: radar...broadcasting and TV networks and telecommunication equipment...it had been observed in some countries that occupational microwave exposure led to the appearance of autonomic and central nervous system disturbances, asthenic syndromes, and other chronic effects (Gordon, 1966; Marha et al., 1971; Dumanski et al., 1975; Serdjuk, 1977)....Similar syndromes were reported in France by Deroche (1971) and in Israel by Moscovici et al. (1974).¹⁷

Some of the occupational microwave exposures that were the subject of studies in the 60's and 70's were in the same power density range as Wi-Fi. Whatever the power density levels of the causative agent(s) were for any persons, once sensitized to this radiation, they often cannot tolerate being in an indoor environment with Wi-Fi and commensurate radiofrequency radiation sources without severe perturbations of their neurological, cardiovascular and other functions.

In the intervening time period, the WHO has taken wireless industry money, sometimes not so overtly; in one instance a \$100,000 contribution was funneled by the wireless industry through Royal Adelaide Hospital for the WHO EMF Project. This incident is recounted by the epidemiologist Dr. Devra Lee Davis in her 2010 book Disconnect: The Truth About Cell Phone Radiation, What the Industry had Done to Hide It, and How to Protect Your Family.¹⁸ In 2011, shortly before the WHO's IARC committee was set to review the evidence on radiofrequency radiation (which includes pulse modulated microwaves from wireless devices), a Swedish journalist outed the head of the committee, Anders Ahlbom, as a paid consultant to the wireless industry. He was summarily kicked off the committee, which met and went on to categorize RF radiation with diesel exhaust, lead, DDT and chloroform.

Still, some members of the committee, including Lennart Hardell, the world's expert on the health effects of wireless devices, whose work was the basis for a European court declaring that cell and cordless phones are causing brain tumors, maintain that evidence exists such that wireless radiation from cell phones should have been categorized as Group 1, if the evidence had been judged the way other agents have been judged according to the Hill criteria¹⁹. If this had

¹⁷ “Radiofrequency and Microwaves” Environmental Health Criteria 16: Published under the joint sponsorship of the United Nations Environment Programme, the World Health Organization, and the International Radiation Protection Association, World Health Organization, Geneva: 1981: 11, 80.
http://apps.who.int/iris/bitstream/10665/39107/1/9241540761_eng.pdf

¹⁸ Davis, Devra L., Disconnect: The Truth About Cell Phone Radiation, What the Industry had Done to Hide It, and How to Protect Your Family. Dutton, 2010. <http://www.disconnectbook.com/>.

¹⁹ Hardell L and Carlberg M. Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. *Rev Environ Health*. 2013; 28(2-3):97-106.

been done, governments automatically would have been forced to restrict the use of Wi-Fi, cell phones, etc. in public. In the United States, the wireless industry provides more income to the Treasury than any other industry except oil and gas; many experts assert that politicization is at work in the way in which some elements in our society deal with (ignore or deny) the hazards of wireless devices and transmitters. Some asserting this include Frank Clegg, the former head of Microsoft Canada, who told the Wall Street Journal that there are people who cannot attend school due to Wi-Fi and gave a briefing in 2015 on the dangers of Wi-Fi and wireless radiation to the Massachusetts State House²⁰; Gro Harlem Brundtland, former head of the WHO and Prime Minister of Norway; Stephen Sinatra, MD, the integrative cardiologist; the American Academy of Environmental Medicine (“AAEM”)²¹ and even management at the New York State Union of Teachers (“NYSUT”) which held an event in December 2014 called “Our Love Affair with Wireless Technologies is Making Us Sick”²².

In June, Israel’s Supreme Court ruled that the Ministry of Education was illegally forcing parents to buy wireless tablets for children’s use in school after 100 or so parents sued the Ministry for violating its parental rights and ignoring literature that showed that radiation in Wi-Fi’ed schools and in the vicinity of wireless devices were linked with serious biological effects. In April, Israel’s 3rd largest city disconnected the Wi-Fi in the K-12 school system²³ and in March, a bill was introduced in Congress in Argentina, a G-20 nation²⁴ that would ban Wi-Fi in public areas, including hospitals (and would mandate that cell phones be shut off in emergency areas). In November 2015, the Austrian Medical Association recommended that hard-wiring be used instead of Wi-Fi.²⁵

This brings me to the most recent developments in the United States. On May 9th, the National Institute of Environmental Health Sciences (NIEHS) held a seminar at one of its Research

²⁰ Wireless Right to Know Briefing, Massachusetts State House Boston, Environmental Health Trust, 6/10/15: <https://vimeo.com/134411701>

²¹ The American Academy of Environmental Medicine (AAEM) “Recommendations Regarding Electromagnetic and Radiofrequency Exposure”: 7/12/12: <https://www.aeonline.org/pdf/AAEMEMFmedicalconditions.pdf>; The American Academy of Environmental Medicine (AAEM) Position Paper, “Electromagnetic and Radiofrequency Fields Effect on Human Health”: 4/12/12: <https://aaeonline.org/pdf/emfpositionstatement.pdf>.

²² Havas M. Our love affair with wireless technologies is making us sick. New York State Union of Teachers (NYSUT), December 9, 2014: <http://scholar.aci.info/view/14f8fe83eab00130010/1501ef5a51d000115d8>

²³ Haifa municipality disconnects Wi-Fi: הפיח תייריע -ה ירישכמ תא - Wi-Fi רפסה יתבו מידלי ינגב ריעב תקתנמ, 4/18/16. <http://www.local.co.il/haifa/134582/Article/>

²⁴ Argentina seeks a national law against electromagnetic pollution: “Argentina busca una ley nacional contra la contaminacion electromagnetica” *El Nuevo Cronista*, 3/28/16. <http://www.nuevocronista.com/argentina-busca-una-ley-nacional-contra-la-contaminacion-electromagnetica/>

²⁵ Vienna Medical Association, 10 Medical Cell Rules, “10 Medizinische Handy-Regeln”: 11/12/15. http://www2.aekwien.at/1964.py?Page=1&id_news=8972; <http://www.aekwien.at/aekmedia/Medizinische-Handy-Regeln.pdf>

Triangle Park facilities on Electromagnetic Hypersensitivity Syndrome (EHS). On May 26th, the National Toxicology Program (NTP) released some of the data from its \$25 million cell phone study²⁶ that was commissioned in 2001. NTP staff confirmed on a conference call on the same day that 1/15 of the rats irradiated with cell phones for 9 hours a day (10 minutes on and 10 minutes off for 18 hours) for 28 days developed cancer or pre-cancerous lesions.

This study has the weight and imprimatur of the United States Federal government behind it. It is now not possible for credible institutions to say that there is a "controversy" as to whether wireless radiation causes serious biological effects or that the federal government guarantees wireless devices to be safe or that microwave radiation only has thermal effects (causes tissue heating). The federal government now acknowledges what scientists and the industry itself have long known, that microwave radiation causes biological damage well below heating thresholds and legal levels. Scientists such as Dr. Joel Moskowitz, at the University of California, Berkeley, assert that on the basis of this study, there is enough data to categorize radiofrequency radiation as a Group 1 carcinogen as Dr. Hardell previously stated in 2013.

The FCC is promoting more wireless rollout while the re-insurance industry is sounding alarm bells. Note: "Exclusions" from a Lloyd's of London policy:

We will not

- a) make any payment on your behalf for any claim, or
- b) incur any costs and expenses, or
- c) reimburse you for any loss, damage, legal expenses, fees or costs sustained by you, or
- d) pay any medical expenses:

....directly or indirectly arising out of, resulting from or contributed to by electromagnetic fields, electromagnetic radiation, electromagnetism, radio waves or noise.²⁷

The federal government now has acknowledged as of May 26th that cell phones have deleterious effects on animals well below the heating threshold and admitted in 2002 that there is a population of people with severe sensitivities to electromagnetic radiation who are covered under the ADA and who per survey studies and clinical reports appears to be highly statistically significant.

By the FCC's own acknowledgment, the guidelines are only set so that people do not pass out: "The limit on specific absorption associated with the reduced averaging time is conservative

²⁶ Wyde M, Cesta M, Blystone C, Elmore S, Foster P, Hooth M, Kissling G, Malarkey D, Sills R, Stout M, Walker N, Witt K, Wolfe M, Bucher J. Report of Partial Findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley rats (Whole Body Exposure): <http://biorxiv.org/content/early/2016/05/26/055699.full.pdf+html>

²⁷ Exclusions from a Lloyd's of London policy (starting on Page 6 of policy, continuing on Page 8). <http://www.citizensforsafetechnology.org/Lloyds-of-London-excludes-coverage-for-RFEMR-claims,2,4168>

relative to RF-induced unconsciousness and is well above the threshold for auditory effect.”²⁸ (Note: the FCC does admit that some people can hear the radiation frequencies within legal thresholds, so they have long acknowledged that there is a biological effect from publicly allowable exposures.) The FCC also uses standards that were set on the basis of only four studies of acute (not chronic) exposures to what appear to be rhesus, macaque and squirrel monkeys and possibly some rats. In other words, the standards were not set on the basis of chronic exposures to humans:

Despite the greatly expanded database since ANSI C95.1-1982, most reports of biological effects have embodied acute exposures at relatively few frequencies..... the most sensitive measures of potentially harmful biological effects were based on the disruption of ongoing behavior associated with an increase in body temperature in the presence of electromagnetic fields. Because of the paucity of reliable data on chronic exposures, IEEE subcommittee 4 focused on evidence of behavioral disruption under acute exposures...Because the threshold for disruption in non-human primates always exceeded a whole-body SAR of 3.2 to 4 W/Kg [B15, B17, B18, B19], the latter value has again been adopted as the working threshold for unfavorable biological effects in human beings in the frequency range of 100KHz- 300 GHz.²⁹

The Department of the Interior (DOI) wrote the National Telecommunications and Information Administration (NTIA) a letter on February 7, 2014 stating that the FCC standards are “now nearly 30 years out-of-date and inapplicable today”. The FCC has failed to acknowledge a-thermal effects (ones that occur below the heating threshold and legal limits) that other agencies such as DOI, as well as the Air Force, the Defense Intelligence Agency/US Army Medical Intelligence, U.S. Naval Observatory Biosciences Division, NASA, the Radiofrequency Interagency Working Group (RFIAWG), the EPA, the EU, the Canadian Standing Parliamentary Committee on Health and the industry itself have acknowledged exist. (See Appendix A.) To recap: the FCC set standards by ignoring thousands of studies that showed serious effects at levels well below these standards and by selecting a mere four animal behavioral studies with acute exposures that were not appropriate to the chronic exposure conditions the FCC enabled in the human environment; then after they requested comment on said standards around two decades later, the FCC was told by DOI that their standards are three decades out of date, and still nothing has been done three years after the Request for Comment.

The FCC is not a health agency and independent institutions like the Harvard Safra Center have asserted that it is wholly captured by the companies it is supposed to regulate; the FCC allowed them to set the standards. (See Appendix B). The fox effectively is guarding the chicken coop, while other federal agencies have indicated that the FCC’s standards are NOT science-based.

If a federal agency had guidelines that stipulated it was legal to spray DDT, diesel exhaust, chloroform or aerosolized lead in the indoor environment and much of the outdoor environment constantly (these items, like radiofrequency radiation, are Group 2B carcinogens), individual institutions would act and not place such agents inside or around the premises, and Congress

²⁸ IEEE C95.1-1991 "Revision of ANSI C95.1.-1982" IEEE Standard for Safety Levels with Respect to Human Exposure to Radio-Frequency Electromagnetic Fields, 3KHz-300GHz, IEEE: April 27, 1992: 33-34.

²⁹ Ibid., 27, 28, 46.

would have immediate hearings and propose interventions. The agent in question is odorless, colorless, and while the majority does not appear to react overtly, a statistically significant number do and another sizeable tranche appear to be affected who have not made the link between symptoms and exposure.

Judge Frederick Weisberg of the D.C. Superior Court is on record as stating that "Federal law is the supreme law of the land, but there is no constitutional provision that says federal facts are the supreme facts of the land. Federal law can preempt state law, but it cannot preempt scientific fact. The scientific truth, whatever it may be, lies outside of the FCC's regulations about what is 'safe' or 'unsafe.'"

The FCC must cease and desist from compounding an already unacceptable public health problem. Congress must immediately hold hearings and decouple health and standard setting so it is not under the FCC's purview. Presumptions of safety are not based on the scientific record of the health effects of radiofrequency radiation. The FCC should not be acting in ways that make it more difficult to enforce the ADA and that degrades the public's health further.

As long as corporations and lobbyists have disproportionate power and enable the FCC Commissioners to have the power to take the decisions it proposes, its Commissioners should stop, read the literature, look in the mirror and ask themselves what they are doing. Is being able to download a video faster something the FCC should be enabling when such a scheme will cause more biological dysfunction, more suffering and more civil rights violations? The answer is obviously NO. While it seems that the Commissioners do not want to acknowledge what other federal agencies and the scientific community are saying about microwave radiation (again, See Appendices A and B), it should be obvious to the Commissioners that they should not be rolling out more permanent infrastructure and intensifying its use when they asked for comment on the standards almost 3 years ago and have not completed that review.

Deborah Kopald

APPENDIX A

The federal RFIAGW (Radiofrequency Interagency Working Group) asserted in 1999 (16 years ago) that standards are not protective of human health, specifically stating,

"The past approach of basing the exposure limits on acute effects data with an extrapolation to unlimited chronic exposure durations is problematic." The letter goes on to point out that peak exposure isn't factored into guidelines which are averaged. Also, the biological effects of frequency, pulse or intensity modulation aren't factored into the guidelines. It also discusses how Specific Absorption Rate (SAR) limits do not account for the fact that different tissues interact differently with microwave radiation: e.g. brain and bone marrow absorb more radiation than fat or fascia.

Like the ICNIRP statement on page 3, RFIAGW states that there is variation in “susceptibility (response/sensitivity) among individuals” and that this uncertainty should be factored into the guidelines.³⁰

In 1993 the EPA wrote to the FCC saying its safety guidelines are inadequate and that radiofrequency radiation exposures in “uncontrolled environments” (i.e. public areas) were “not well defined” (see pages 2 and 3 of the letter from the EPA’s Director of the Office of Radiation and Indoor Air to FCC’s Chief Engineer at the Office of Engineering and Technology³¹ that prefaces the official comments). The comments go on to state that the FCC does not adequately distinguish between a “controlled” and “uncontrolled” environment; EPA asserts that uncontrolled environments are non-discretionary environments (i.e. public environments) and that de facto awareness of the existence of microwave radiation in the environment does not constitute protection. Comments state that FCC guidelines “lack explanation, consistency and well-founded justifications” and ignore a 1984 EPA report³² that stated that there are **variations in sensitivity amongst subgroups of the population**.

Johnson Liakouris AG. Radiofrequency (RF) sickness in the Lilienfeld Study: an effect of modulated microwaves? Arch Environ Health 1998; 53:236–8 cites occupational and clinical cases of RF sickness/ microwave sickness (Cold War terms for EHS) and explains how repeated and/or prolonged exposure worsens the syndrome and that symptoms come sooner and last longer with subsequent exposures.³³ The paper describes the symptoms

³⁰ W. Gregory Lotz, PhD, Chief, Physical Agents Effects Branch, Division of Biomedical and Behavioral Science, National Institute for Occupational Health and Safety (NIOSH) 1999 letter on behalf of the Radiofrequency Interagency Working Group (RFIAGW) to Richard Tell, Chair IEEE SCC28 (SC4) Risk Assessment Working Group: http://www.emrpolicy.org/litigation/case_law/docs/exhibit_a.pdf

³¹ Environmental Protection Agency (EPA) Comments to the Federal Communications Commission (FCC) on FCC 93-142, April 1993, Notice of Proposed Rulemaking: Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation via Margo T. Oge, Director, Office of Radiation and Indoor Air letter to Thomas P. Stanley, Chief Engineer, Office of Engineering and Technology, FCC: http://www.emrpolicy.org/litigation/case_law/docs/epa_to_fcc_3nov_93.pdf

³² Biological Effects of Radiofrequency Radiation, EPA Health Effects Research Laboratory, September 1984: <http://nepis.epa.gov/Exe/ZyNET.exe/300065H1.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1981+Thru+1985&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D:%5c%5cfiles%5cIndex%20Data%5c81thru85%5cTxt%5c00000001%5c300065H1.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7c-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL>

³³ Johnson Liakouris AG. Radiofrequency (RF) sickness in the Lilienfeld Study: an effect of modulated microwaves? Arch Environ Health 1998;53:236–8 <http://www.emrpolicy.org/fag/liakouris.pdf>

including headache, ocular dysfunction, fatigue, dizziness, irritability, concentration problems and sleep disorders.

In 2001, the EU's Directorate General for Research produced a report, "The Physiological and Environmental Effects of Non-Ionising Electromagnetic Radiation" that acknowledged that

The hypersensitivity of the alive human organism to ultraweak microwave radiation is reflected in the ways in which this kind of radiation has been found to affect a wide variety of brain functions...such as EEG, electrochemistry, permeability of the blood/brain barrier and to degrade the immune system....

....there is an undeniable consistency between some of these non-thermal influences and the nature of many of the health problems reported, such as headache, sleep disruption, impairment of short-term memory...

....Thus the reports of

- a) *headache are consistent with the fact that microwaves are known to thermally affect the dopamine-opiate system of the brain and to increase the permeability of the blood-brain barrier, since both of these have been medically connected with headache.*
- b) *Sleep disruption are consistent with the effect of GSM (European mobile phone) radiation on... REM sleep and on melatonin levels- the latter being found epidemiologically in the case of RF exposure.*
- c) *Memory impairment is consistent with the finding that microwave radiation targets the hippocampus.*³⁴

A pertinent email dated 2010 from the then-head of the California Public Utilities Commission (CPUC) Michael Peevey to Pacific Gas and Electric (PG&E) executive Brian Cherry has recently become public and is on point. Note his written acknowledgment of what is understood by many members of the scientific and medical communities: "**There really are people who feel pain, etc., related to EMF, etc.....**" Peevey goes on to indicate they should be accommodated (by not forcing a wireless electric meter on their homes) if they can produce a doctor's letter saying they suffer "**from EMF and/or related electronic-related illnesses**" or "**expressing concern about likelihood of suffering same.**"³⁵ I make reference to the relationship between wireless electric meters and Wi-Fi routers and cell towers in my article "Legal and Public Health Problems of the Wireless

³⁴ The Physiological and Environmental Effects of Non-Ionising Electromagnetic Radiation, European Parliament Directorate General for Research, 2001:
[http://www.europarl.europa.eu/RegData/etudes/etudes/join/2001/297574/DG-4-JOIN_ET\(2001\)297574_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/etudes/join/2001/297574/DG-4-JOIN_ET(2001)297574_EN.pdf)

³⁵ Michael R. Peevey, Chairman of the California Public Utilities Commission (CPUC) 2010 email to Brian K. Cherry, Pacific, Gas and Electric (PG&E):
ftp://ftp2.cpuc.ca.gov/PG&E20150130ResponseToA1312012Ruling/2010/09/SB_GT&S_0000529.pdf

Age", which was posted by Stanford Law School Professor Brian Wolfman on the Consumer Law and Policy Blog³⁶. Proximity to all result in the symptoms in question.

Over 200 scientists from 40 countries issued an appeal in May to the World Health Organization (WHO) and the United Nations Environment Programme (UNEP) that requested that "medical professionals be educated about the biological effects of electromagnetic energy" and that "white-zones (radiation-free areas) be established." ³⁷

In 2011, the Council of Europe Parliamentary Assembly cited research showing "there was such a syndrome of intolerance to electromagnetic fields" and refers to accommodation provided in Sweden:

*60. Here, too, the rapporteur stresses that some people may be more sensitive than others to electromagnetic radiation or waves. The research performed, for instance, by Professor Dominique Belpomme, President of the Association for Research and Treatments Against Cancer (ARTAC), on more than 200 people describing themselves as "electro-sensitive" **succeeded, with corroborative results of clinical and biological analyses, in proving that there was such a syndrome of intolerance to electromagnetic fields across the whole spectrum of frequencies....Sweden has granted sufferers from (11 Doc. 12608) electromagnetic hypersensitivity the status of persons with reduced capacity so that they receive suitable protection.***

*61. In connection with the proven or potential risks of electromagnetic fields, **it should also be noted that after a Lloyd's report, insurance companies tended to withhold coverage for risks linked with electromagnetic fields under civil liability policies,** in the same way as, for example, genetically modified organisms or asbestos, which is hardly reassuring given the potential risks that stem from these electromagnetic fields.* ³⁸

Among many citations amongst the armed forces, this excerpt from a 1988 Air Force report, "Radiofrequency microwave radiation: biological effects and safety standards: a review" is on point and describes the neurological dysfunction to the central nervous system that has been recorded from so-called low-level radiation:

*"There is documented evidence that exposure to RF/MW radiation can cause a disturbance in the central nervous system (CNS) of living organisms. Soviet investigators claim that **exposure to low-level radiation can induce serious CNS dysfunctions**. Experiments conducted in the Soviet Union and Eastern Europe have exposed live subjects to radiation levels that are near or below the recommended safe levels prescribed by the ANSI Standard and the USAF AFOSH Standard.*

³⁶ Kopald D. Legal and Public Health Problems of the Wireless Age. *Consumer Law and Policy Blog*, September 9, 2014: <http://pubcit.typepad.com/clpblog/2014/09/legal-and-public-health-problems-of-the-wireless-age.html>, PAR 9.

³⁷ International EMF Scientist Appeal: Scientists Call for Protection from Non-ionizing Electromagnetic Field Exposure, 2015: <https://www.emfscientist.org/index.php/emf-scientist-appeal>

³⁸ "The potential dangers of electromagnetic fields and their effect on the environment", The Council of Europe Parliamentary Assembly, Committee on Environment, Agriculture and Local and Regional Affairs, Huss J. 2011: <http://assembly.coe.int/nw/xml/XRef/Xref-DocDetails-EN.asp?FileID=13137&lang=EN>

The NIOSH Technical Report [81 summarized the results of a pathological study published by A. A. Letavet and Z. V. Gordon in 1960. They reported that several CNS related disorders were discovered among 525 workers exposed to RF/MW radiation. The symptoms were listed as: hypotension, slower than normal heart rates, an increase in histamine content of the blood, an increase in the activity of the thyroid gland, disruption of the endocrine-hormonal process, alterations in the sensitivity to smell, headaches, irritability, and increased fatigue. Other researchers have acknowledged similar biological responses³⁹.

In fact the increased histamine content in people manifesting symptoms of sensitivity to EMFs reported in the 1960 Letavet and Gordon pathological study that was referenced in the Air Force report above was found in the work of Dominique Belpomme, which was referenced in the Council of Europe citation (see again, footnote 38). Belpomme's research was published in November 2015: (See: Belpomme D, Campagnac C, Irigaray P. Reliable disease biomarkers characterizing and identifying electrohypersensitivity and multiple chemical sensitivity as two etiopathogenic aspects of a unique pathological disorder. *Rev Environ Health*, 2015; 30(4): 251–271).

In 1965, Ford's Research and Scientific Laboratory commissioned a report from a German researcher called "The Effect of Microwaves on the Central Nervous System" by W. Bergman that reported sensitivity to microwave radiation in patients who had previous nerve injuries:

Gebhardt, Saidman, Cahen, Dausset, and Weissenberg observed that patients who had recovered from neuralgia and neuritis and who were in the vicinity of a short-wave transmitter, in some cases sensed a slightly painful tingling, even though the disease had not been manifest for years. These sensations extended exclusively to the nerve region which had previously been pathologically affected; thus, a weak high-frequency energy, which is transmitted to the human body in the form of electromagnetic waves, is sufficient to influence sensory nerves. Weissenberg furthermore reports that when patients with acute neuralgia were exposed to the condenser field, they suffered such violent pain that the equipment had to be disconnected.

This latter finding is consistent with modern day clinical reports.

*Schweitzer even reports that the severest pain reactions were sometimes observed in cases of neuritis with the application of minimum dosage.*⁴⁰

In 1969, the U.S. Naval Observatory Biosciences Division chronicled in the proceedings of a symposium it held the biological phenomena that manifested from chronic exposure

³⁹ "Radiofrequency Microwave Radiation: Biological Effects and Safety Standards: A Review" Scott Bolen, Rome Laboratory, Air Force Materiel Command, Griffiss Air Force Base, New York, 1988: <https://electroplague.files.wordpress.com/2014/09/rf-microwave-radiation-biological-effects-rome-labs.pdf> Pages 11-12.

⁴⁰ "The Effect of Microwaves on the Central Nervous System" Translated from the German for Research and Scientific Laboratory, Ford Motor Company, W. Bergman, 1965: http://www.magdahavas.com/wordpress/wp-content/uploads/2010/12/German_Ford_Motor_company_The_Effect_of_Microwaves_on_The_Central_Nervous_System.pdf Pages 10-13.

to microwave radiation in the workplace, citing the development of a syndrome with three stages. The symptoms described are the symptoms of EHS noted by modern day-clinicians and in the Austrian Medical Association's Guidelines for the Diagnosis of EMF Syndrome. The report refers to exposures in the hundredths of milliWatts/cm², which would correspond to exposures being close and in the beam of a cell transmitter and up close to a high-powered public Wi-Fi hotspot. The paper also states that the group exposed to the lowest exposure levels manifested the highest rates of complaints⁴¹. This suggests the evidence of power density windows which prompts a question as to whether any continual exposure to this radiation truly can be safe.

In 1973 the World Health Organization (WHO) in conjunction with the then-named United States Department of Health, Education and Welfare sponsored the Warsaw Symposium: Biological and Health Hazards of Microwave Radiation. In the presentation "The Biologic Action and Hygienic Significance of Electromagnetic Fields of Superhigh and Ultrahigh frequencies in densely populated areas", JD Dumanskij and MG Sandala noted statistically significant changes in the brain cortex of rabbits at levels commensurate with a present-day Wi-Fi'ed environment (.06 µW/cm² in the UHF band; 5 GHz Wi-Fi operates within the UHF band) and in the level of severe concern per the Institute for Building Biology and Ecology Standards.⁴²) It should also be noted that rabbits often are used by researchers as a proxy for teenagers:

...upon prolonged irradiation, the strength of the process of inhibition within the brain hemisphere cortex was appreciably increased, as evidenced by the appearance of slow rhythms in the electroencephalograms. The observed changes in bioelectric activity of the brain cortex of rabbits confirmed previously reported results of studies on conditioned reflex activity of animals and showed that electromagnetic fields in the UHF and SHF ranges appreciably lowered blood cholinesterase activity...

...In addition we studied the influence of electromagnetic energy in the UHF range upon carbohydrate-phosphorous metabolism. These investigations showed that a prolonged exposure to a field of .06-10 µW/cm² intensity resulted in disturbances in glycogen metabolism, i.e. a reduction in the glycogen content in the liver due to increased phosphorylase activity accompanied by simultaneous accumulation of lactic acid. At the same time a marked influence of UHF fields on oxidative coupling and phosphorylation processes in rat liver mitochondria was detected. Long-term irradiation led to a fall of phosphorylation and oxidation functions of hepatic mitochondria.

The biologic experiments were complemented by histomorphologic studies which showed that the lesions which appeared under the influence of electromagnetic energy in the UHF and SHF ranges took the form of dystrophic changes in the brain, liver, spleen, and testes, along with impairment in blood circulation.

Analysing the results of the above experimental investigations, it should be noted that prolonged action of electromagnetic energy of low intensities in the UHF and SHF ranges resulted in

⁴¹ Dodge CH. "Clinical and Hygienic Aspects of Exposure to Electromagnetic Fields." Naval Observatory Biosciences Division Symposium Proceedings, Richmond, VA (BRH/DBE 70-2) September 17-19, 1969. http://www.magdahavas.com/wordpress/wp-content/uploads/2010/08/Dodge_1969.pdf

⁴² IBE RF Standards: <http://hbelc.org/pdf/standards/SBM-2008C-v3.6.pdf>, page 7, (last viewed 02/3/16).

*appreciable changes in the general status of the organism, conditioned reflex activity, bioelectric activity of the brain cortex, a number of biochemical parameters, blood composition, and morphologic structures of the tissues and organs of the animals under study*⁴³.

A 1976 report prepared by US Army Medical Intelligence, Office of the Surgeon General for the Defense Intelligence Agency, "Biological Effects of Electromagnetic Radiation (RadioWaves and Microwaves) Eurasian Communist Countries" records reported effects of RF Sickness/Microwave Sickness/EHS:

*Subjects exposed to microwave radiation exhibited a variety of neurasthenic disorders against a background of angiodystonia (abnormal changes in toxicity of blood vessels). The most common subjective complaints were headache, fatigue, perspiring, dizziness, menstrual disorders, irritability, agitation, tension, drowsiness, sleeplessness, depression, anxiety, forgetfulness, and lack of concentration*⁴⁴

The report goes on to describe heart rate effects which are found in the present-day research of Magda Havas. (See again: footnote 4):

*Heavy emphasis has been placed on investigations involving electromagnetic radiation on the cardiovascular system. Effects on hemodynamics include blood pressure variations and cardiac arrhythmias. Also included are reports of a slowdown of intraventricular and intra-atrial conduction, diffuse cardiac muscular changes, and ventricular extrasystole. As with other effects, animal studies are frequently reported and human reports are typically retrospective in nature. Many of the variations noted on the cardiovascular system result from central nervous system effects.*⁴⁵

A 1981 report by NASA's Goddard Flight Center, "Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories" documents symptoms of sensitization from microwave radiation, citing a 1978 report by Stuchly (headaches, disturbed sleep at night, memory impairment, pain in muscles and heart region, fatigue, dizziness, etc.) and a 1978 report by Dwyer (bradycardia, hypotension, increase in histamine content in the blood, increased fatigability, periodic or constant headaches). A table in the NASA report also cites studies showing symptoms well below Wi-Fi'd power densities: (Bise: changes in electroencephalogram, loss of memory, inability to concentrate, irritability).⁴⁶

⁴³ World Health Organization and United States Department of Health, Education and Welfare, Warsaw Symposium, "Biological and Health Hazards of Microwave Radiation, 1973, Session E. Occupational Exposure and Public Health Aspects of Microwave Radiation http://mistic.heig-vd.ch/taillard/microwave_effects/, Pages 29-33.

⁴⁴ Biological Effects of Electromagnetic Radiation (Radio-waves and Microwaves) Eurasian Communist Countries, Defense Intelligence Agency, Prepared by US Army Medical Intelligence and Information Agency, Office of the Surgeon General, March 1976, RL Adams, RA Williams: http://www.magdahavas.com/wordpress/wp-content/uploads/2011/02/BIOLOGICAL_EFFECTS_OF_ELECTROMAGNETIC_RADIATION-RADIOWAVES_AND_MICROWAVES-EURASIAN_COMMUNIST_COUNTRIES.pdf, Page 14.

⁴⁵ Ibid, Defense Intelligence Agency, page 11.

⁴⁶ Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. NASA purchase order No. S-75151B April, 1981. Prepared for Goddard Flight Center, Greenbelt, MD. www.robindestoits.org/attachment/489726/

In 2002, Norbert Hankin, a senior EPA scientist, restated the obvious conclusion of the EPA's findings communicated in their 1993 letter to the FCC (See again: footnote 31), "The generalization by many that the guidelines protect human beings from harm by any and all mechanisms is not justified."⁴⁷

In 2014, U.S Department of the Interior (DOI) sent a letter to the National Telecommunications and Information Administration (NTIA) with effectively the same conclusion: "The electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now 30 years out of date and inapplicable today."⁴⁸

APPENDIX B

Most recently, the Edmond J. Safra Center for Ethics at Harvard University published a paper by journalism fellow Norm Alster that cites (S. Sivani and D. Sudarsanam — Impacts of Radio-Frequency Electromagnetic Field (RF-EMF) from Cell Phone Towers and Wireless Devices on Biosystem and Ecosystem – A Review, *Biology and Medicine* 4.4 (2013): 202) in which they state:

Based on current available literature, it is justified to conclude that . . . [electromagnetic fields] . . . can change neurotransmitter functions, blood-brain barrier, morphology, electrophysiology, cellular metabolism, calcium efflux, and gene and protein expression in certain types of cells even at lower intensities."

The Harvard Safra Center paper also refers to the Levitt and Lai transmitter metastudy⁴⁹ that documents symptoms at sensitization at distances away from cell towers that would create radiation exposures lower than those found in some Wi-Fi'ed environments today. It quotes two studies (Santini, R., Santini, P., Danze, J.M., Le Ruz, P., and Seigne, M. 2002. Enquete sur la sante de riverains de stations relais de telephonie mobile : Incidences de la distance et du sexe. *Pathol. Biol.* 50: 369–373. doi:10.1016/S0369-8114(02)00311-5) and (Abdel-Rassoul, G., El-Fateh, O.A., Salem, M.A., Micgael, A., Farahat, F., and Salem, E. 2007. Neurobehavioral effects among inhabitants around mobile phone base stations. *Neurotoxicology*, 28(2): 434–440. doi:10.1016/j.neuro.2006.07.012) that would have occurred before Wi-Fi was ubiquitous or even very common in those locations (meaning that Wi-Fi would not have been likely to be responsible for the symptoms recorded):

⁴⁷ Norbert Hankin, Center for Science and Risk Assessment, EPA Radiation Protection Division July 6, 2002 letter to Janet L. Newton, President, The EMR Network: <http://www.aemc.gov.au/Media/docs/Market-Review-Submission-EPR0022---Helen-Weir---121009---Supporting-document-3-85f00cf2-edec-4fb3-9ce4-d3166da1e356-0.PDF> Page 3 of PDF (Page 2 of the Hankin letter)

⁴⁸ Willie R. Taylor, Director, Office of Environmental Policy and Compliance, United States Department of the Interior, Office of the Secretary February 7, 2014 letter to Eli Veenendaal, National Telecommunications and Information Administration: http://www.ntia.doc.gov/files/ntia/us_doi_comments.pdf, Page 5.

⁴⁹ Levitt B, Lai H. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. *Environ Rev* 2010; 18:369–95.

They summarized the results on one 2002 study that compared the health of 530 people living at various distances within 300 meters of cell towers with a control group living more than 300 meters away. "Results indicated increased symptoms and complaints the closer a person lived to a tower"...."Significant differences were observed up through 100m for irritability, depressive tendencies, concentration difficulties, memory loss, dizziness and lower libido.

A 2007 study conducted in Egypt found similar results. Levitt and Lai report, "Headaches, memory changes, dizziness, tremors, depressive symptoms and sleep disturbance were significantly higher among exposed inhabitants than controls."⁵⁰

Many of the exposures in the tower studies cited in the Levitt and Lai metastudy were at or below radiation levels found in present day Wi-Fi'ed environments. Rolling out more transmitter infrastructure to enable the use of more Wi-Fi'ed and higher-powered devices will interfere with providing accommodation under the ADA and worsen the public's health. At a minimum, further rollouts should not occur when the 2013 Request for Comment on radiation standards has not been reviewed. Congressional hearings on the scope of the problem are necessary, and the FCC should not be permitted to set its own standards since an adequate performance of that task conflicts with the FCC's stated mission to promote the rollout and use of more of the radiation-emitting technology.

⁵⁰ Captured Agency: How the Federal Communications Commission is Dominated by the Industries it Presumably Regulates: http://ethics.harvard.edu/files/center-for-ethics/files/capturedagency_alster.pdf, Page 11.

Radiation Sickness - Children; Dr. Ann Lee MD.
(Petitioner) Comments; Sep. 30, 2016

Hello,

I am a physician and my training is in physical medicine and rehabilitation. I have a son who was diagnosed with a heart murmur when he was five years old. This was found on a routine physical exam required for admission to public school. An echocardiogram confirmed he had a loose heart valve with regurgitation. My son had no symptoms at the time, so the cardiologist said we could just follow up if he developed any new symptoms in the future.

Two years later, my son started to complain of chest pain for the first time after visiting the second floor of a newly built library in Palo Alto for a tutoring session. This occurred every week when we visited his tutor at the library. We repeated his echocardiogram, which I suspected would show a worsening heart defect. To my surprise, it was normal. His cardiologist said the murmur had resolved and my son had the "heart of an athlete." When I asked what could have caused my son's chest pain, he said he wasn't sure and to come back if there were any worsening symptoms. My son was seven years old then.

The cardiologist's reply didn't satisfy my physician's or mother's instinct. I couldn't find anything in the medical textbooks about chest pain in children with structurally normal hearts, so I resolved to look online through pubmed as well as "google it." On the web, I found several studies which showed adverse biological effects from wireless radiation and reports of children experiencing unusual, sometimes generalized symptoms of nausea, headache, skin rashes and chest pain, etc. after their school installed WiFi routers in the classrooms.

I did some investigation and looked for routers in the library. On the floor where he used to get tutoring, there were seven routers on the ceiling and almost every adult there was accessing them wirelessly on their laptops. My son's school also had WiFi routers in every other classroom. However, he did not complain of chest pain at school. I decided we would avoid going to the library and leave it at that.

Then in April 2016, California public schools performed a standardized test. All the students in his classroom had to access the test using their laptops wirelessly. This was the first time he complained of experiencing chest pain at school. He was eight years old.

I shared some of the studies I found with my friend Amrutha Kattamuri, who was chairperson of the safety committee on our school Site Council. She performed her own investigation and also reached out to several research experts in the field of microwave radiation and health. Since then, we have been laboring to educate as many parents as possible, as well as teachers, school officials, board members, PTA representatives, etc.

My story is one of many but it is the science behind this movement that is compelling.

In May 2016, the United States National Toxicology Program, part of the U.S. Dept of Health and Human Services, released the results of an animal study on cell phone radiation. This study showed a statistically significant increase in brain gliomas and heart schwannomas in exposed rats (900 MHz). The mice protocol will be completed by end of 2017 (1900 MHz exposure).

A few years earlier, in 2013, professor Martin Pall, PhD, of Washington State University had published papers showing how voltage-gated calcium channels (VGCC) may become dysregulated in the presence of wireless radiation of extremely low and microwave frequencies (cell phone and WiFi frequencies) leading to adverse biological effects involving peroxynitrite, an oxidant which promotes inflammation and intracellular damage including DNA.

As VGCC are mostly found in excitable tissues, the brain and heart would likely be most effected from these types of exposures. Inflammatory factors promoted by peroxynitrite may be involved in biomarkers found in patients diagnosed with electrohypersensitivity and multiple chemical sensitivity (Rev Environ Med, 2015). VGCC overexpression has been detected in glioblastomas (Cancers, 2015,7,pg 856).

Although these findings have been reproduced, there is currently much debate in the scientific community whether wireless radiation has any relevance to human health or require further regulation by governing bodies. The Center for Ethics at Harvard University published a paper titled Captured Agency, which addresses the conflict of interest which spurs on much of this debate.

Recently, there have been measures taken by local governments in San Francisco and Berkeley to warn the public of wireless radiation and its possible health effects by labeling mobile phone products with the same warnings that manufacturers place within the legal information page of each product. They were both sued by the Cellular Telephone Industries Association (CTIA), who represent the \$200 billion dollar mobile phone industry.

Organizations which support stricter regulations on wireless radiation include the American Academy of Pediatrics and the California Medical Association. In 2011, the International Agency for Research on Cancer (IARC, a division of the World Health Organization) had classified wireless radiation as a class 2b carcinogen, which is in the same class as lead, DDT and car exhaust. International scientists have appealed to the UN and WHO to promote public awareness and education about wireless radiation and adverse health effects.

Despite this, the FCC, FDA and CDC state there is "no scientific evidence" or that there is no science to link cell phone use to health problems. These statements are untrue as demonstrated by the U.S. NTP study and are not appropriate responses from regulating agencies when there is science to show reasons to take precautionary measures.

The following are a couple of scientific presentations which you may find interesting:

<https://www.youtube.com/watch?v=ma-OVwNnKvU>

<https://www.youtube.com/watch?v=a6wLFeIrCtU>

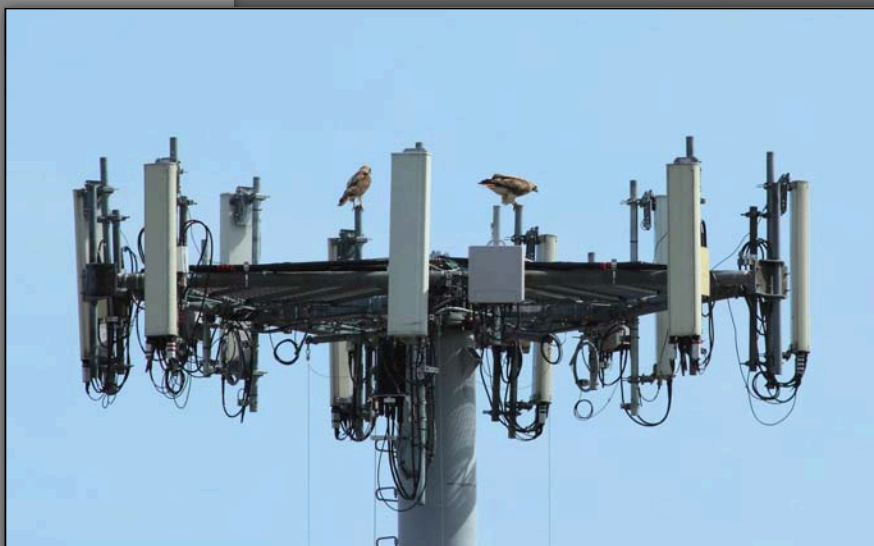
Do not install DSA cell sites in our residential neighborhoods where children reside. We will be sure to contact our representatives to notify them of our concerns.

Sincerely,

Ann Lee MD

Radiation Sickness; Health Effects of Microwave Radio Exposures.
Dr. Paul Dart MD. (Petitioner) Comments, Sep. 3, 2013

Health Effects of Microwave Radio Exposures



Paul Dart MD FCA

The current FCC Limits for Microwave RF Exposure were published in 1999.

These guidelines are only designed to protect the public against the thermal effects of microwave RF.

The FCC has explicitly stated that they do not make any regulations or assurances whatsoever regarding the “nonthermal” biological effects of lower level microwave RF exposures (other physiologic effect besides heat damage).

Many statements from industry spokesmen state that “not enough is known” about these exposures to identify risk, or that there is “insufficient” or “incomplete” evidence regarding such risks, or that there is “no scientific consensus” on this risk.

This implies that there isn’t much scientific information on this subject. But actually, there is a great deal of research documenting adverse biological effects from low level RF exposures.

Acute Symptoms from RF Exposure: “EHS”



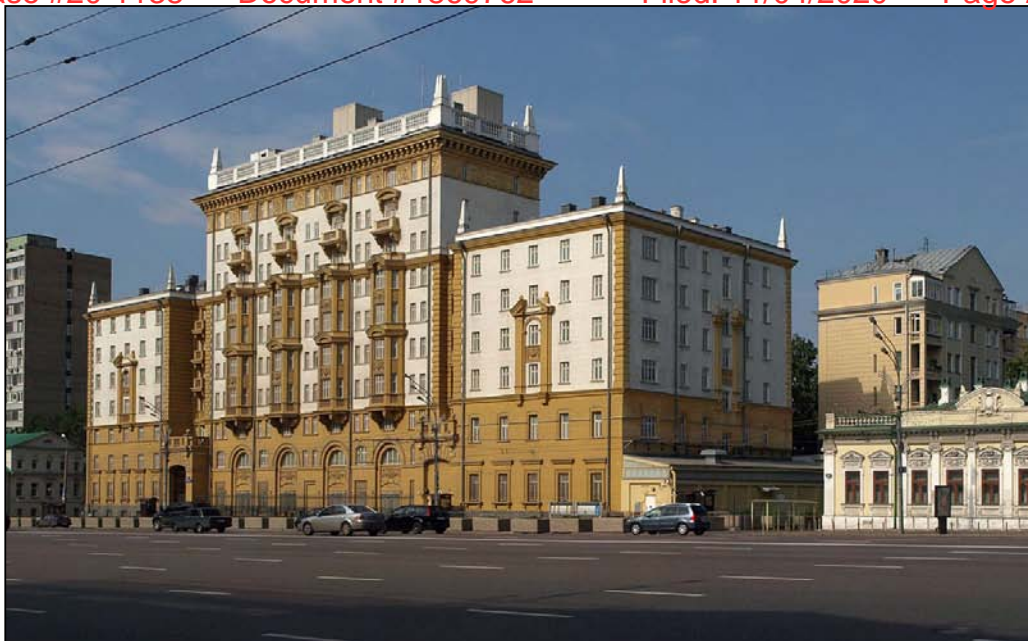
In this presentation, we’re going to take a look at the current scientific evidence for adverse effects of RF exposures.

First, we’ll look at the evidence that RF exposures can produce acute symptoms in many individuals.

Then we’ll look at the evidence that RF exposures alter hormone physiology and increase oxidative stress in living systems.

Then we’ll review the evidence that such alterations in physiology can damage DNA, increase the incidence of some forms of cancer, and decrease fertility in animals and in human beings.

U.S. Embassy, Moscow (1953-1978)



Acute symptoms provoked by microwave radiation were first described by Russian medical researchers in the 1950's. They described a constellation of symptoms including headache, ocular dysfunction, fatigue, dizziness, sleep disorders, dermatographism, cardiovascular abnormalities, depression, irritability, and memory impairment.

In the years between 1953 and 1978 the Russian government harassed the U.S. Embassy in Moscow by targeting it with radiation from a microwave transmitter positioned on the roof of a nearby building.

Exposed embassy staff experienced a statistically significant excess of several problems, including: depression, irritability, difficulty in concentrating, memory loss, ear problems, skin problems, vascular problems, and other health problems. Symptom incidence increased significantly with accrued years of exposure.

Exposure levels inside the building were in the order of 2 to 28 $\mu\text{W}/\text{cm}^2$ (FCC Guidelines: 600 $\mu\text{W}/\text{cm}^2$)

U.S. Embassy, Moscow (1953-1978)

50272-101		1. REPORT NO.		2.	3. P8288163
REPORT DOCUMENTATION PAGE		4. Title and Subtitle		5. Report Date	
		Evaluation of Health Status of Foreign Service and other Employees from Selected Eastern European Posts		July 31, 1973	
7. Author(s)		8. Performing Organization Rept. No.			
Abraham M. Lilienfeld, M.D.					
Principal Investigator					
9. Performing Organization Name and Address		10. Project/Task/Work Unit No.			
Department of Epidemiology					
School of Hygiene and Public Health					
The Johns Hopkins University					
12. Sponsoring Organization Name and Address		11. Contract(C) or Grant(G) No.			
Medical Director		(C) 6025 619073			
Office of Medical Services		(G)			
Department of State		13. Type of Report & Period Covered			
Washington, D C		Final			
		1953 - 1976			
15. Supplementary Notes		14.			
Released publicly November 20 simultaneously by Department of State and The Johns Hopkins University.					
16. Abstract (Limit: 200 words)					
This is a biostatistical study of 1827 Department of State employees and their dependents at the Moscow Embassy and 2561 employees and their dependents from other Eastern European Embassies. Health records, health questionnaires and death certificates were the basic information sources. The study is the impact of the Moscow environment including microwave exposure on the health status and mortality of the employees. It was concluded that personnel working at the American Embassy in Moscow from 1953 to 1976 suffered no ill effects from the microwaves beamed at the Embassy.					

Concern about health effects among Embassy personnel led to a detailed study by A.M. Lilienfeld, an epidemiologist at Johns Hopkins University. The abnormalities found in this study were an embarrassment to the U.S. government, since the levels of exposure experienced by embassy staff inside the building were in the order of 2 to 28 microwatts/cm², a level dramatically below the described U.S. safety standards for microwave exposure. It appears that the conclusions of the study were altered to soft-pedal any abnormal findings.

Lilienfeld AM LGM, Cauthen J, Tonascia S, Tonascia J. Evaluation of health status of foreign service and other employees from selected eastern European embassies. *Foreign Service Health Status Study, Final Report*; Contract No. 6025-619037 (NTIS publication P8-288 163/9) (1979); 1-447.

Liakouris AG. Radiofrequency (RF) Sickness in the Lilienfeld Study: An Effect of Modulated Microwaves? *Archives of Environmental Health* (1998); 53(3):236-238.

Goldsmith JR. Where the trail leads. Ethical problems arising when the trail of professional work leads to evidence of a cover-up of serious risk and misrepresentation of scientific judgement concerning human exposures to radar. *Eubios Journal of Asian and International Bioethics* (1995b); 5(4):92-94.

Cherry N. Evidence of Health Effects of Electromagnetic Radiation, To the Australian Senate Inquiry into Electromagnetic Radiation (2000): 1-84. http://www.necil.cherry.com/documents/90_m1_EMR_Australian_Senate_Evidence_8-9-2000.pdf

Norway (1998)



From:

Mild, K.H., Oftedal, G., Sandstrom, M., Wilen, J., Tynes, T., Haugsdal, B. and Hauger E., 1998: "Comparison of symptoms by users of analogue and digital mobile phones - A Swedish- Norwegian epidemiological study". National Institute for Working Life, 1998:23, Umea, Sweden, 84pp.

Norway (1998)

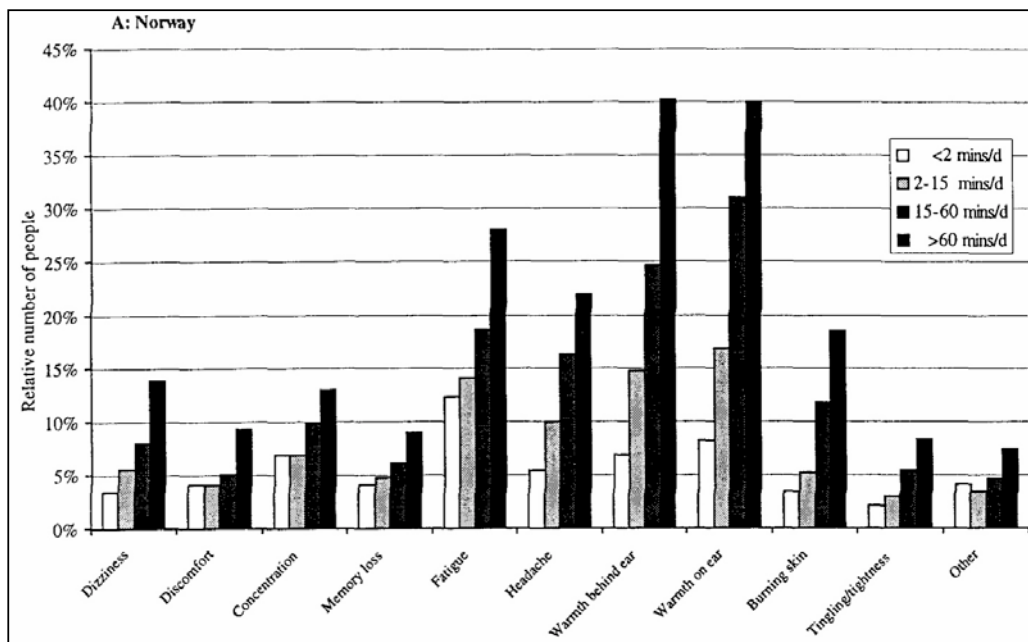


Figure 11: Prevalence of symptoms for Norwegian mobile phone users, mainly analogue, with various categories of length of calling time per day, from Mild et al. (1998).

In:

Cherry N. EMF / EMR Reduces Melatonin in Animals and People. (2002):1-14. <http://www.neilcherry.com/documents.php>

From:

Mild, K.H., Oftedal, G., Sandstrom, M., Wilen, J., Tynes, T., Haugsdal, B. and Hauger E., 1998: "Comparison of symptoms by users of analogue and digital mobile phones - A Swedish- Norwegian epidemiological study". National Institute for Working Life, 1998:23, Umea, Sweden, 84pp.



Town of 1900 inhabitants, with GSM cell phone tower.

Questionnaire distributed, 5% of inhabitants responded. The questionnaire was composed of 25 different items mainly concerning health information about the respondents.

The respondents scored and marked from 0 to 3 the presence of the suffered health dysfunction: 0 never, 1 sometimes, 2 often, 3 very often.

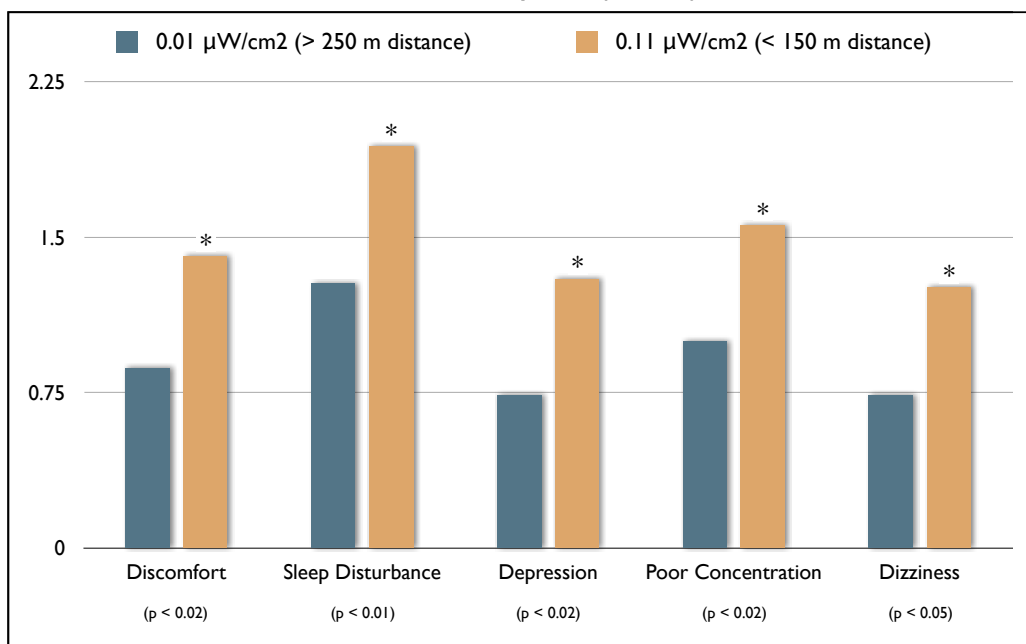
Power density of signal in bedrooms of respondents was measured.

Area A (< 150 meters from tower) = average power density $0.11 \mu\text{W}/\text{cm}^2$.

Area B (> 250 meters from tower) = average power density $0.01 \mu\text{W}/\text{cm}^2$.

Navarro E, Segura J, Portolés M, Gómez-Perretta C. The Microwave Syndrome: A Preliminary Study in Spain. *Electromagn Biol Med* (2003); 22(2-3):161-169.

La Ñora, Spain (2001)



Symptom score (0 – 3) vs Average Bedroom Exposure Levels to Microwave RF

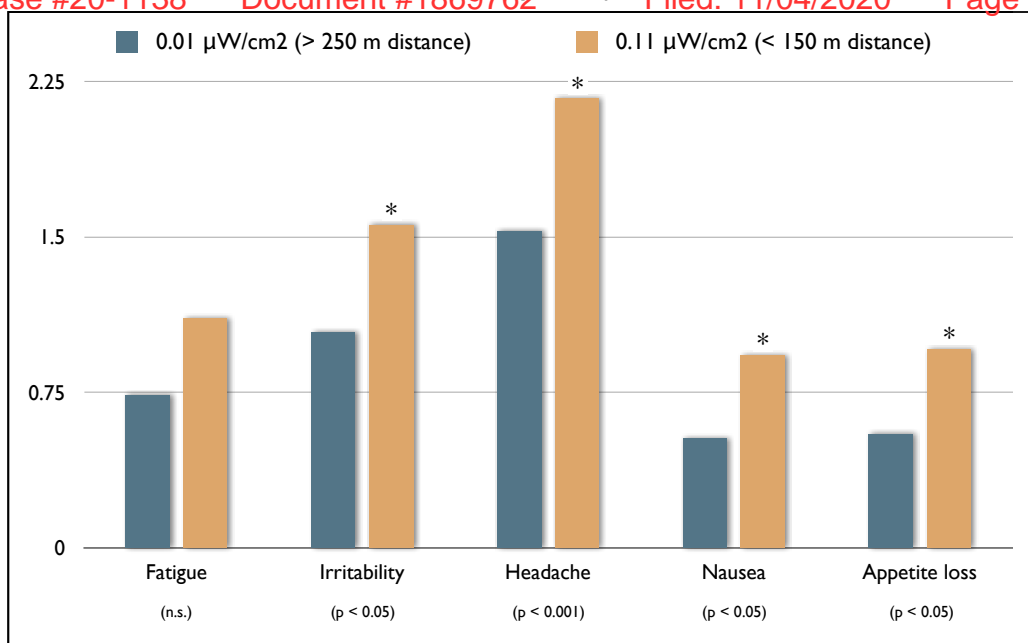
FCC Guidelines: 600 - 1000 $\mu\text{W}/\text{cm}^2$

Navarro E, Segura J, Portolés M, Gómez-Perretta C. The Microwave Syndrome: A Preliminary Study in Spain. *Electromagn Biol Med* (2003); 22(2-3):161-169.

Abstract

A health survey was carried out in Murcia, Spain, in the vicinity of a Cellular Phone Base Station working in DCS-1800 MHz. This survey contained health items related to "microwave sickness" or "RF syndrome." The microwave power density was measured at the respondents' homes. Statistical analysis showed significant correlation between the declared severity of the symptoms and the measured power density. The separation of respondents into two different exposure groups also showed an increase of the declared severity in the group with the higher exposure.

La Ñora, Spain (2001)



Symptom score (0 – 3) vs Average Bedroom Exposure Levels to Microwave RF

Based on the data of this study the advice would be to strive for levels not higher than 0.02 V/m for the sum total, which is equal to a power density of 0.0001 $\mu\text{W}/\text{cm}^2$ or 1 $\mu\text{W}/\text{m}^2$, which is the indoor exposure value for GSM base stations proposed on empirical evidence by the Public Health Office of the Government of Salzburg in 2002.

Oberfeld G, Navarro E, Portoles M, Maestu C, Gomez-Perretta C. The Microwave Syndrome -- Further Aspects of a Spanish Study. (2004):1-8. http://www.powerwatch.org.uk/pdfs/20040809_kos.pdf

France (2002)



Questionnaire re multiple symptoms that have been described for “microwave syndrome”.

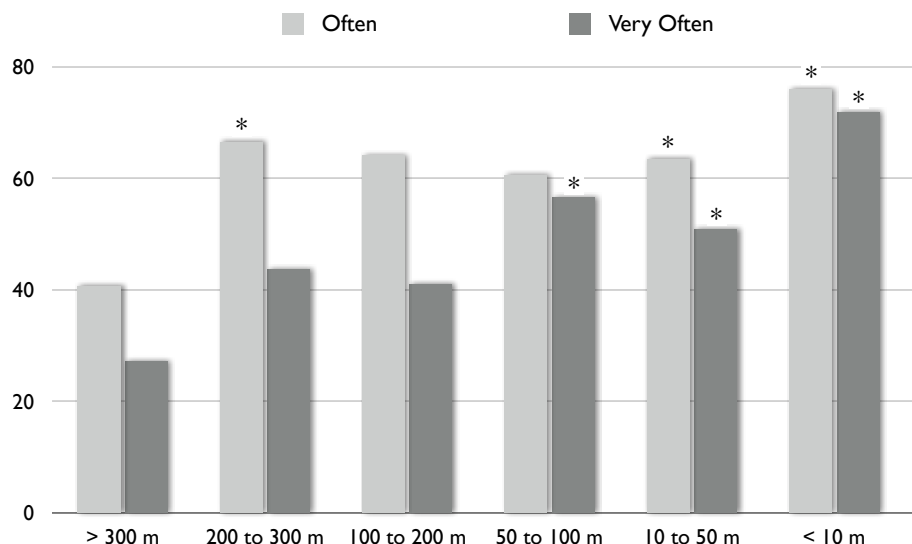
n = 530

Evaluated incidence of symptoms as a function of residential proximity in meters to a cell phone tower.

Santini R, Santini P, Danze JM, Le Ruiz P, Seigne M. [Investigation on the health of people living near mobile telephone relay stations: I/Incidence according to distance and sex]. *Pathol Biol (Paris)* (2002); 50(6):369-373.

Santini R SP, Le Ruiz P, Danze J, Seigne M. Survey Study of People Living in the Vicinity of Cellular Phone Base Stations. *Electromagnetic Biology and Medicine* (2003); 22(1):41-49.

Fatigue



* p < 0.05 in comparison to residence > 300 meters or not exposed.

X axis = responses grouped by residential proximity to cell phone tower (in meters).

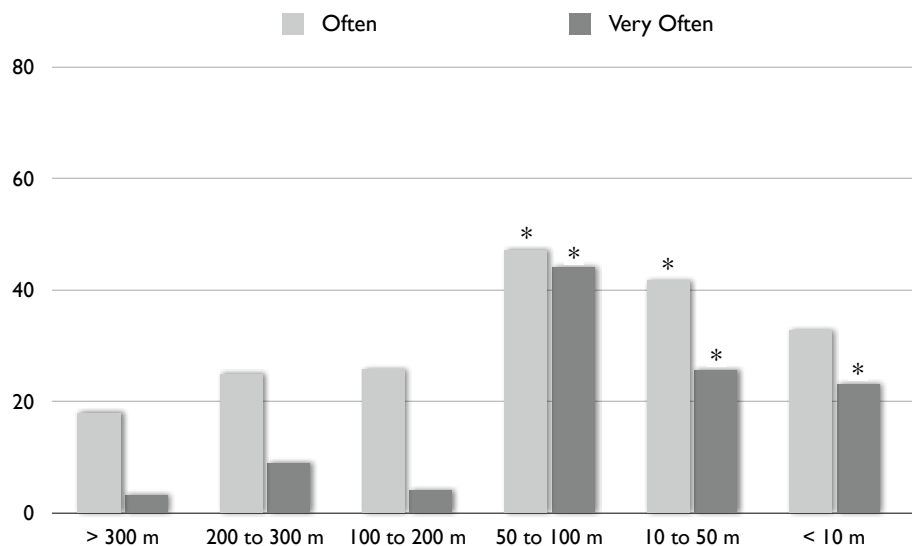
Y axis = percentage in exposure category answering "Often" or "Very Often" to a symptom query, in reference to total number of respondents living at that distance who answered "Never" to that symptom query.

* = statistically significant for this sample size.

Santini R, Santini P, Danze JM, Le Ruz P, Seigne M. [Investigation on the health of people living near mobile telephone relay stations: I/Incidence according to distance and sex]. *Pathol Biol (Paris)* (2002); 50(6):369-373.

Santini R SP, Le Ruz P, Danze J, Seigne M. Survey Study of People Living in the Vicinity of Cellular Phone Base Stations. *Electromagnetic Biology and Medicine* (2003); 22(1):41-49

Irritability



* p < 0.05 in comparison to residence > 300 meters or not exposed.

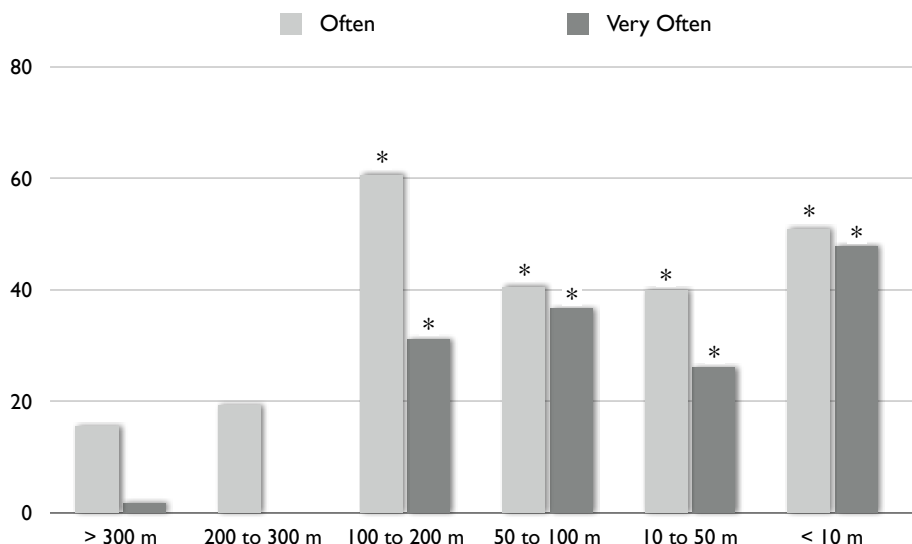
X axis = responses grouped by residential proximity to cell phone tower (in meters).

Y axis = percentage in exposure category answering "Often" or "Very Often" to a symptom query, in reference to total number of respondents living at that distance who answered "Never" to that symptom query.

* = statistically significant for this sample size.

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* p < 0.05 in comparison to residence > 300 meters or not exposed.

X axis = responses grouped by residential proximity to cell phone tower (in meters).

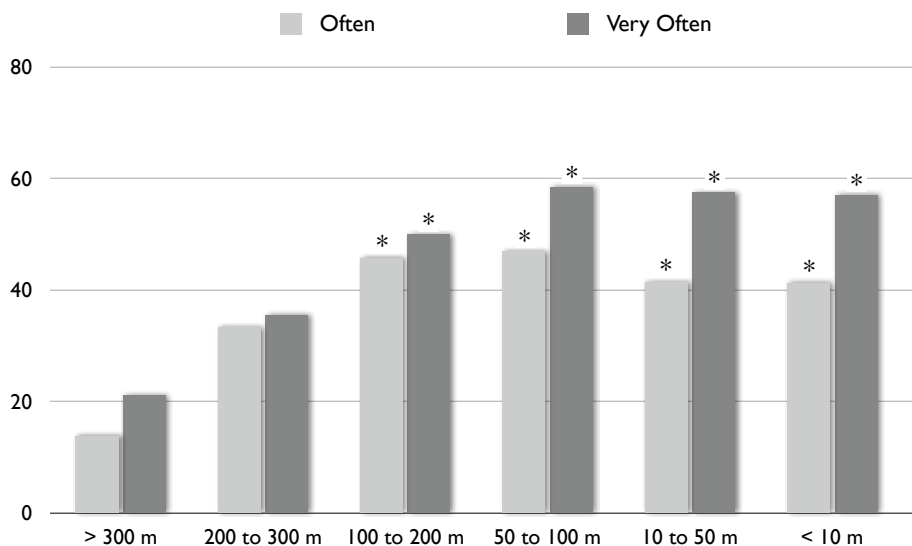
Y axis = percentage in exposure category answering "Often" or "Very Often" to a symptom query, in reference to total number of respondents living at that distance who answered "Never" to that symptom query.

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Santini R SP, Le Ruz P, Danze J, Seigne M. Survey Study of People Living in the Vicinity of Cellular Phone Base Stations. *Electromagnetic Biology and Medicine* (2003); 22(1):41-49

Sleep Disruption



* p < 0.05 in comparison to residence > 300 meters or not exposed.

X axis = responses grouped by residential proximity to cell phone tower (in meters).

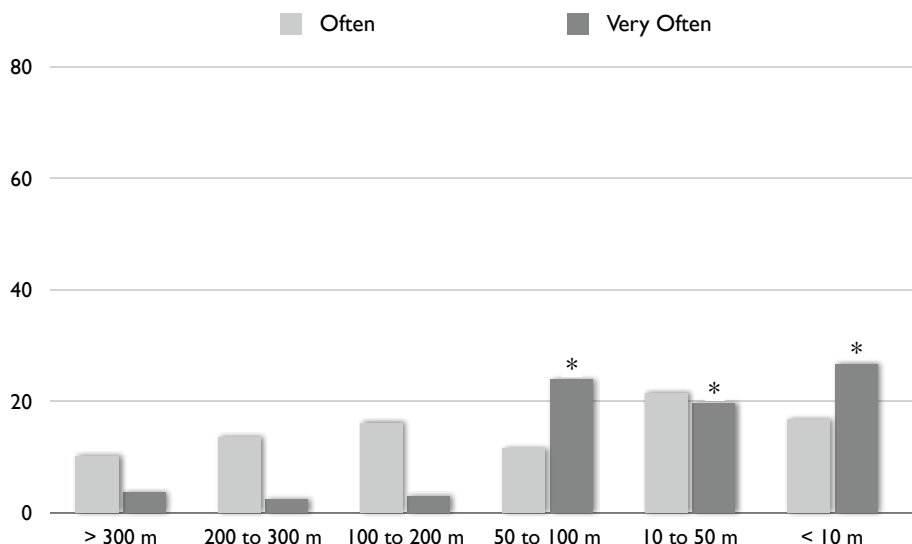
Y axis = percentage in exposure category answering "Often" or "Very Often" to a symptom query, in reference to total number of respondents living at that distance who answered "Never" to that symptom query.

* = statistically significant for this sample size.

Santini R, Santini P, Danze JM, Le Ruz P, Seigne M. [Investigation on the health of people living near mobile telephone relay stations: I/Incidence according to distance and sex]. *Pathol Biol (Paris)* (2002); 50(6):369-373.

Santini R SP, Le Ruz P, Danze J, Seigne M. Survey Study of People Living in the Vicinity of Cellular Phone Base Stations. *Electromagnetic Biology and Medicine* (2003); 22(1):41-49

Depression



* p < 0.05 in comparison to residence > 300 meters or not exposed.

X axis = responses grouped by residential proximity to cell phone tower (in meters).

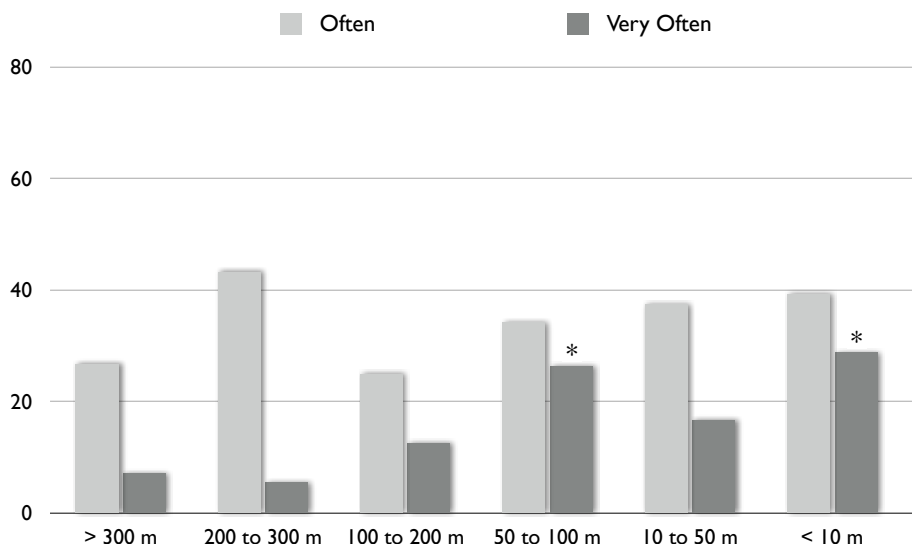
Y axis = percentage in exposure category answering "Often" or "Very Often" to a symptom query, in reference to total number of respondents living at that distance who answered "Never" to that symptom query.

* = statistically significant for this sample size.

Santini R, Santini P, Danze JM, Le Ruz P, Seigne M. [Investigation on the health of people living near mobile telephone relay stations: I/Incidence according to distance and sex]. *Pathol Biol (Paris)* (2002); 50(6):369-373.

Santini R SP, Le Ruz P, Danze J, Seigne M. Survey Study of People Living in the Vicinity of Cellular Phone Base Stations. *Electromagnetic Biology and Medicine* (2003); 22(1):41-49

Difficulty in Concentration



* p < 0.05 in comparison to residence > 300 meters or not exposed.

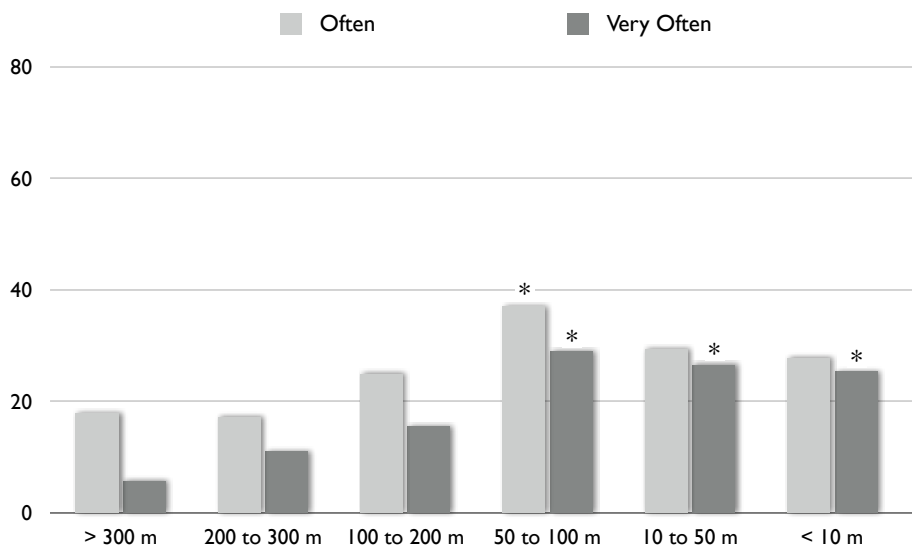
X axis = responses grouped by residential proximity to cell phone tower (in meters).

Y axis = percentage in exposure category answering "Often" or "Very Often" to a symptom query, in reference to total number of respondents living at that distance who answered "Never" to that symptom query.

* = statistically significant for this sample size.

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* p < 0.05 in comparison to residence > 300 meters or not exposed.

X axis = responses grouped by residential proximity to cell phone tower (in meters).

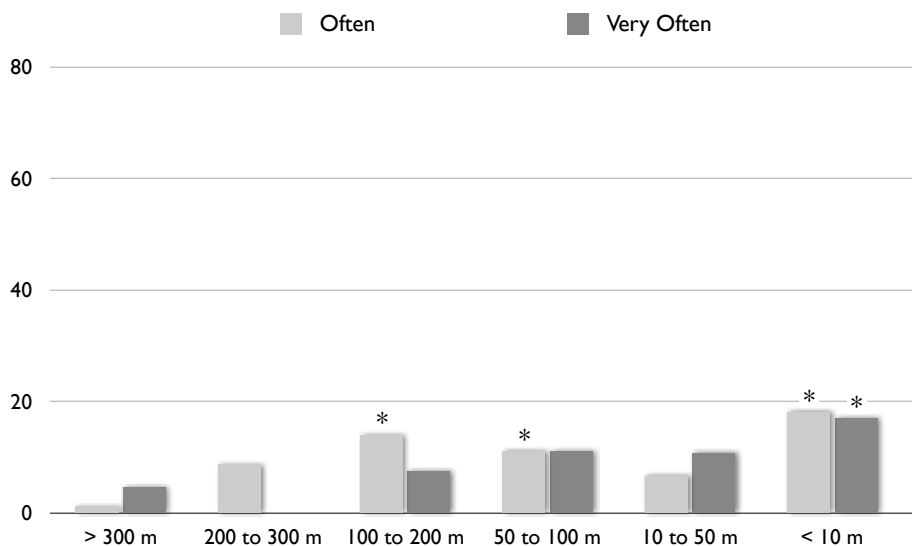
Y axis = percentage in exposure category answering "Often" or "Very Often" to a symptom query, in reference to total number of respondents living at that distance who answered "Never" to that symptom query.

* = statistically significant for this sample size.

Santini R, Santini P, Danze JM, Le Ruz P, Seigne M. [Investigation on the health of people living near mobile telephone relay stations: I/Incidence according to distance and sex]. *Pathol Biol (Paris)* (2002); 50(6):369-373.

Santini R SP, Le Ruz P, Danze J, Seigne M. Survey Study of People Living in the Vicinity of Cellular Phone Base Stations. *Electromagnetic Biology and Medicine* (2003); 22(1):41-49

Skin Problems



* p < 0.05 in comparison to residence > 300 meters or not exposed.

X axis = responses grouped by residential proximity to cell phone tower (in meters).

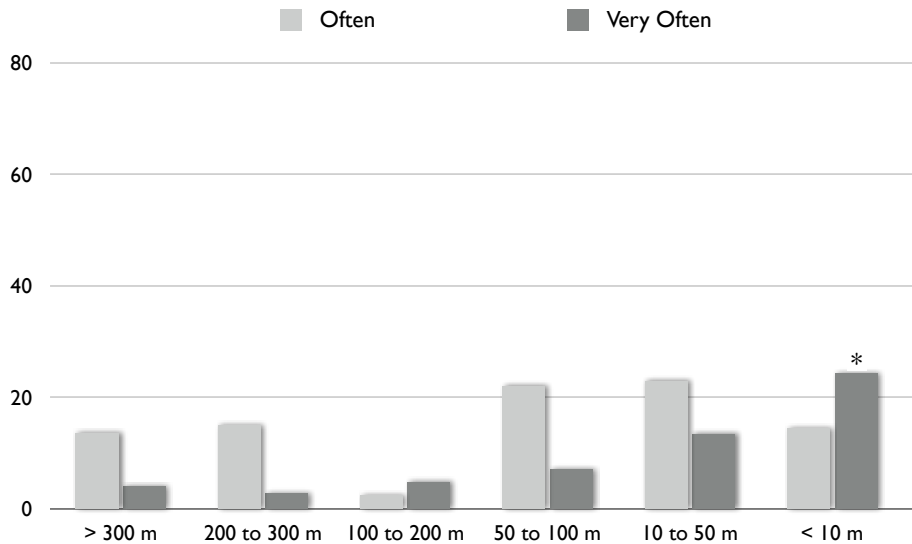
Y axis = percentage in exposure category answering "Often" or "Very Often" to a symptom query, in reference to total number of respondents living at that distance who answered "Never" to that symptom query.

* = statistically significant for this sample size.

Santini R, Santini P, Danze JM, Le Ruz P, Seigne M. [Investigation on the health of people living near mobile telephone relay stations: I/Incidence according to distance and sex]. *Pathol Biol (Paris)* (2002); 50(6):369-373.

Santini R SP, Le Ruz P, Danze J, Seigne M. Survey Study of People Living in the Vicinity of Cellular Phone Base Stations. *Electromagnetic Biology and Medicine* (2003); 22(1):41-49

Visual Disruption



* $p < 0.05$ in comparison to residence > 300 meters or not exposed.

X axis = responses grouped by residential proximity to cell phone tower (in meters).

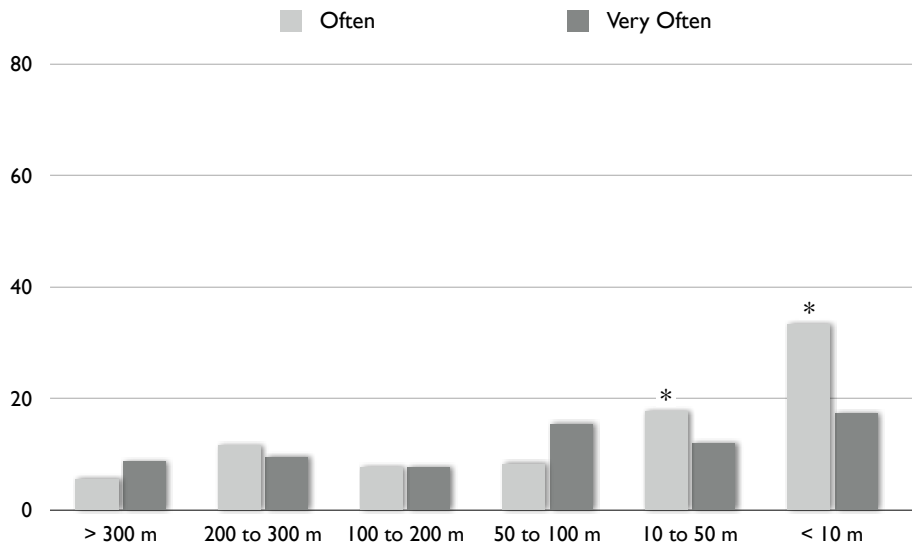
Y axis = percentage in exposure category answering "Often" or "Very Often" to a symptom query, in reference to total number of respondents living at that distance who answered "Never" to that symptom query.

* = statistically significant for this sample size.

Santini R, Santini P, Danze JM, Le Ruz P, Seigne M. [Investigation on the health of people living near mobile telephone relay stations: I/Incidence according to distance and sex]. *Pathol Biol (Paris)* (2002); 50(6):369-373.

Santini R SP, Le Ruz P, Danze J, Seigne M. Survey Study of People Living in the Vicinity of Cellular Phone Base Stations. *Electromagnetic Biology and Medicine* (2003); 22(1):41-49

Hearing Disruption



* $p < 0.05$ in comparison to residence > 300 meters or not exposed.

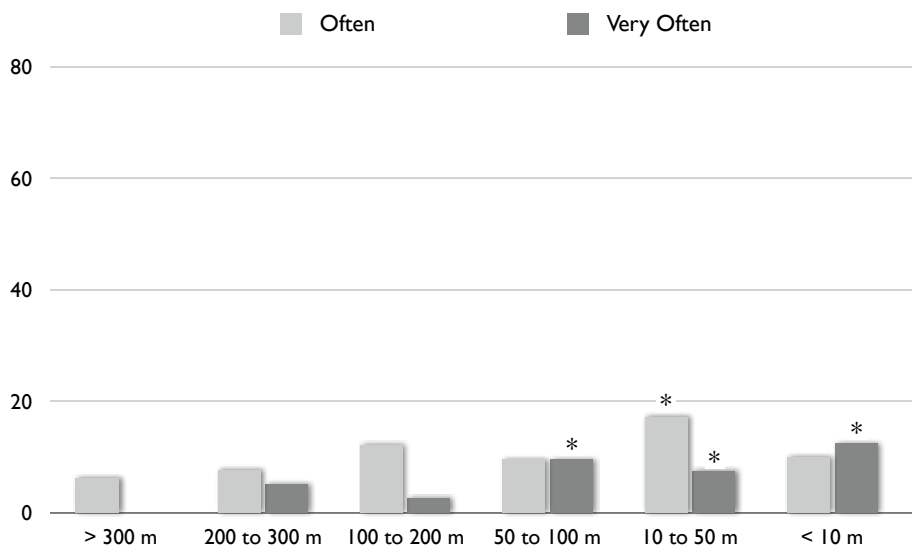
X axis = responses grouped by residential proximity to cell phone tower (in meters).

Y axis = percentage in exposure category answering "Often" or "Very Often" to a symptom query, in reference to total number of respondents living at that distance who answered "Never" to that symptom query.

* = statistically significant for this sample size.

Santini R, Santini P, Danze JM, Le Ruz P, Seigne M. [Investigation on the health of people living near mobile telephone relay stations: I/Incidence according to distance and sex]. *Pathol Biol (Paris)* (2002); 50(6):369-373.

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* p < 0.05 in comparison to residence > 300 meters or not exposed.

X axis = responses grouped by residential proximity to cell phone tower (in meters).

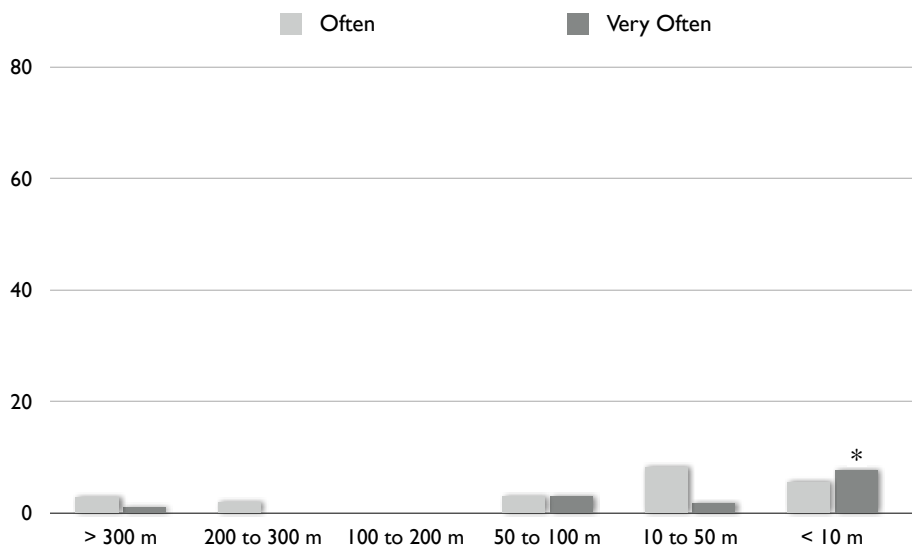
Y axis = percentage in exposure category answering "Often" or "Very Often" to a symptom query, in reference to total number of respondents living at that distance who answered "Never" to that symptom query.

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Santini R SP, Le Ruz P, Danze J, Seigne M. Survey Study of People Living in the Vicinity of Cellular Phone Base Stations. *Electromagnetic Biology and Medicine* (2003); 22(1):41-49

Movement Difficulties



* p < 0.05 in comparison to residence > 300 meters or not exposed.

X axis = responses grouped by residential proximity to cell phone tower (in meters).

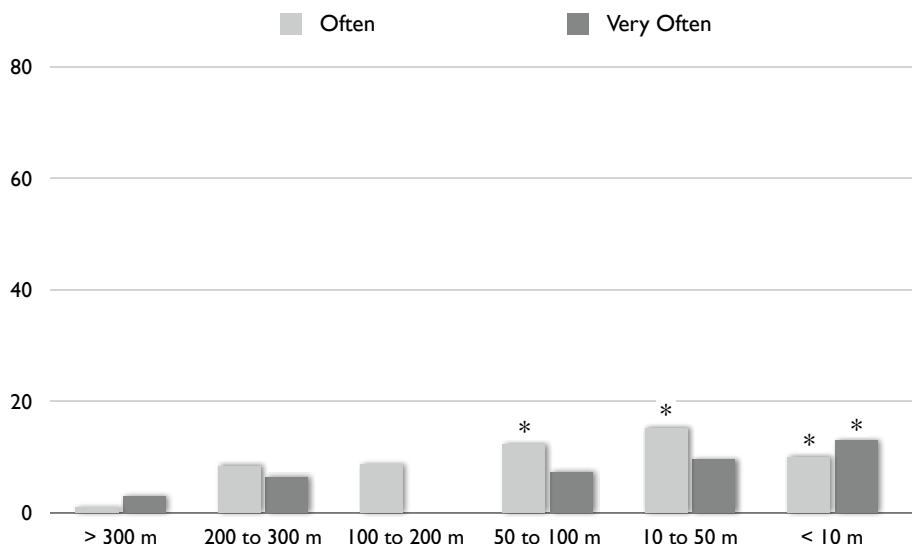
Y axis = percentage in exposure category answering "Often" or "Very Often" to a symptom query, in reference to total number of respondents living at that distance who answered "Never" to that symptom query.

* = statistically significant for this sample size.

Santini R, Santini P, Danze JM, Le Ruz P, Seigne M. [Investigation on the health of people living near mobile telephone relay stations: I/Incidence according to distance and sex]. *Pathol Biol (Paris)* (2002); 50(6):369-373.

Santini R SP, Le Ruz P, Danze J, Seigne M. Survey Study of People Living in the Vicinity of Cellular Phone Base Stations. *Electromagnetic Biology and Medicine* (2003); 22(1):41-49

Cardiovascular Problems



* $p < 0.05$ in comparison to residence > 300 meters or not exposed.

X axis = responses grouped by residential proximity to cell phone tower (in meters).

Y axis = percentage in exposure category answering "Often" or "Very Often" to a symptom query, in reference to total number of respondents living at that distance who answered "Never" to that symptom query.

* = statistically significant for this sample size.

Santini R, Santini P, Danze JM, Le Ruz P, Seigne M. [Investigation on the health of people living near mobile telephone relay stations: I/Incidence according to distance and sex]. *Pathol Biol (Paris)* (2002); 50(6):369-373.

Santini R SP, Le Ruz P, Danze J, Seigne M. Survey Study of People Living in the Vicinity of Cellular Phone Base Stations. *Electromagnetic Biology and Medicine* (2003); 22(1):41-49

Elderly people are more vulnerable

	≤ 20 years		21-40 years		41-60 years		> 60 years	
	Distances of subjects from antennas (in meters)							
Symptoms	≤ 300	> 300	≤ 300	> 300	≤ 300	> 300	≤ 300	> 300
Fatigue	56.7	62.5	82.4*	25	81.4*	57.8	73.3*	40
Irritability	16.2	11.1	46.2	18.2	50.5	35.3	52.1*	21
Headaches	42.4	26.3	57.6*	18.2	52*	13.3	49.5*	10
Nausea	2	0	12.9	0	9.9	0	15.6	15.7
Loss of appetite	13.3	8.8	12.7	0	11.8	0	15.9	15
Sleep disturbances	26.1	14.8	53*	12.5	73.9	52.6	68.5*	44.4
Depressive tendencies	10.2	5.7	14	5.8	36	20	41.7	27.7
Feeling of discomfort	4.4	2.9	26.3	6	41.6	16.6	45*	19
Difficulties in concentration	30.3	40	42.1	18.7	45.8	36.8	53.3*	20
Memory loss	7.5	8	21.8	6.6	45	40	64	36.8
Skin problems	16.6	9.3	24.2	6.6	18.3	0	20.4	5.2
Visual disturbances	16.3	12.5	14.7	12.5	26.6	26.3	36.8	17.6
Hearing disturbances	9.4	5.1	15.4	0	29.8	21.7	43.8	31.5
Dizziness	6.2	5.2	3.2	6.6	15.4	4.5	39.3*	9.5
Movement difficulties	0	2.3	0	0	3.5	4	21.4	10.5
Cardiovascular problems	0	2.3	5.1	0	19.2*	0	36.4	15

for 16 Non Specific Health Symptoms experienced by 530 people (270 men + 260 women) in relation to their distances from cellular phone base stations (≤ 300 m vs. > 300 m [reference group]).

* = $P < 0.05$ for levels of complaints 2 + 3 pooled.

Influence of age on the percentage of complaints

Santini R, Santini P, Danze JM, Le Ruz P, Seigne M. [Investigation on the health of people living near mobile telephone relay stations: I/Incidence according to distance and sex]. *Pathol Biol (Paris)* (2002); 50(6):369-373.

Santini R SP, Le Ruz P, Danze J, Seigne M. Survey Study of People Living in the Vicinity of Cellular Phone Base Stations. *Electromagnetic Biology and Medicine* (2003); 22(1):41-49.

Shebeen El-Kom, Egypt (2003)



Study of 85 inhabitants living near the first cell phone tower in the city (tower operational since 1998).

Abdel-Rassoul G, El-Fateh OA, Salem MA et al. Neurobehavioral effects among inhabitants around mobile phone base stations. *Neurotoxicology* (2007); 28(2): 434-440.

BACKGROUND: There is a general concern on the possible hazardous health effects of exposure to radiofrequency electromagnetic radiations (RFR) emitted from mobile phone base station antennas on the human nervous system. **AIM:** To identify the possible neurobehavioral deficits among inhabitants living nearby mobile phone base stations. **METHODS:** A cross-sectional study was conducted on (85) inhabitants living nearby the first mobile phone station antenna in Menoufiya governorate, Egypt, 37 are living in a building under the station antenna while 48 opposite the station. A control group (80) participants were matched with the exposed for age, sex, occupation and educational level. All participants completed a structured questionnaire containing: personal, educational and medical histories; general and neurological examinations; neurobehavioral test battery (NBTB) [involving tests for visuomotor speed, problem solving, attention and memory]; in addition to Eysenck personality questionnaire (EPQ). **RESULTS:** The prevalence of neuropsychiatric complaints as headache (23.5%), memory changes (28.2%), dizziness (18.6%), tremors (9.4%), depressive symptoms (21.7%), and sleep disturbance (23.5%) were significantly higher among exposed inhabitants than controls: (10%), (5%), (5%), (0%), (8.8%) and (10%), respectively ($P < 0.05$). The NBTB indicated that the exposed inhabitants exhibited a significantly lower performance than controls in one of the tests of attention and short-term auditory memory [Paced Auditory Serial Addition Test (PASAT)]. Also, the inhabitants opposite the station exhibited a lower performance in the problem solving test (block design) than those under the station. All inhabitants exhibited a better performance in the two tests of visuomotor speed (Digit symbol and Trailmaking B) and one test of attention (Trailmaking A) than controls. The last available measures of RFR emitted from the first mobile phone base station antennas in Menoufiya governorate were less than the allowable standard level. **CONCLUSIONS AND RECOMMENDATIONS:** Inhabitants living nearby mobile phone base stations are at risk for developing neuropsychiatric problems and some changes in the performance of neurobehavioral functions either by facilitation or inhibition. So, revision of standard guidelines for public exposure to RFR from mobile phone base station antennas and using of NBTB for regular assessment and early detection of biological effects among inhabitants around the stations are recommended.

Shebeen El-Kom, Egypt (2003)



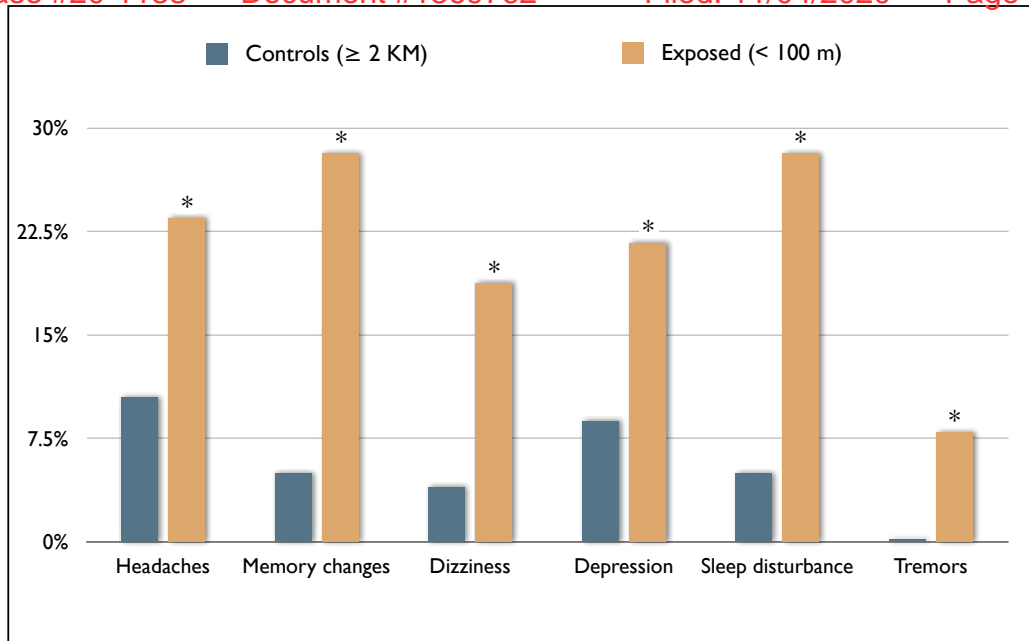
37 subjects lived in the building under the transmitters.

48 others worked in the building across the street.

A control group of 80 individuals worked in a building 2 kilometers away from the towers.

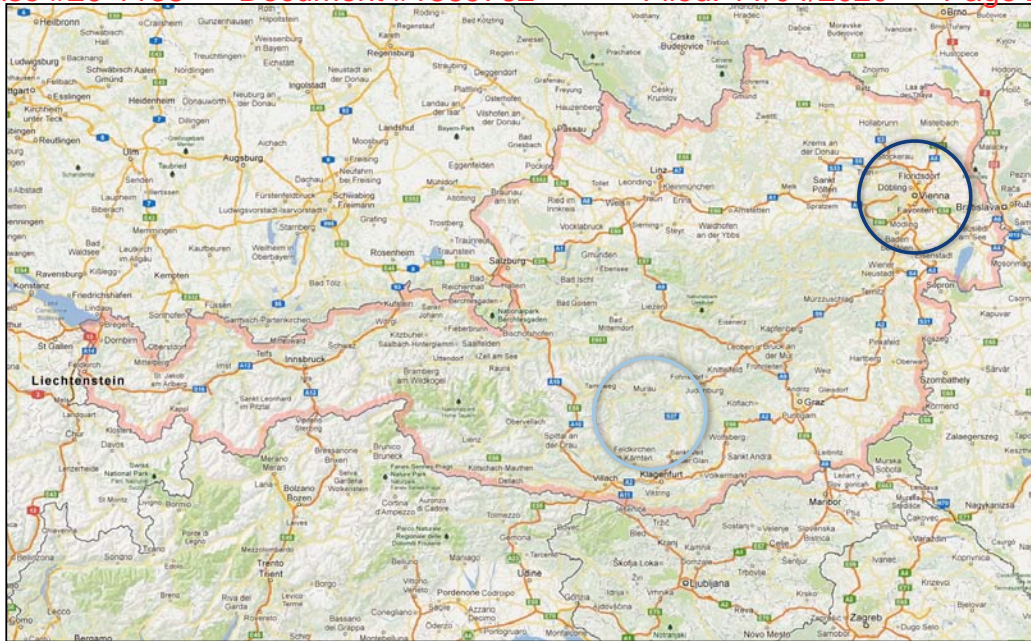
Controls were matched for age, sex, occupation, education level, and mobile phone use.

Shebeen El-Kom, Egypt (2003)



* = statistically significant at this sample size ($p < 0.05$ or better)

Abdel-Rassoul G, El-Fateh OA, Salem MA et al. Neurobehavioral effects among inhabitants around mobile phone base stations. *Neurotoxicology* (2007); 28(2): 434-440.



Study of health effects around 10 cell phone towers ("base stations") in urban and rural Austria.

Criteria:

Towers operational for > 2 years.

No local controversy.

No other towers nearby (when possible).

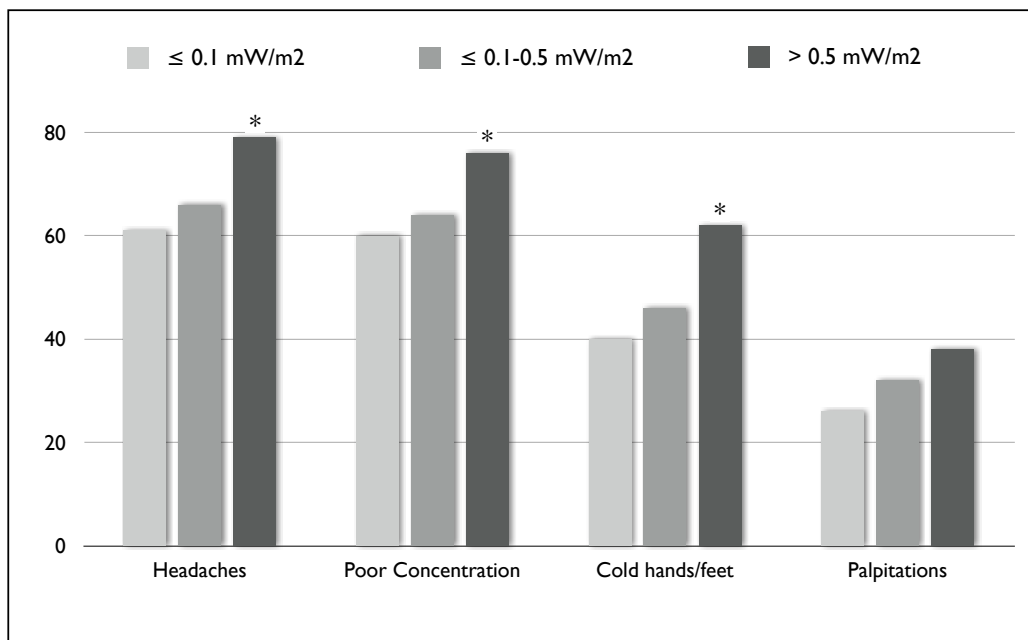
900 MHz transmission.

Random selection of households within the study areas.

Performance tests, symptom questionnaires, exposure measurements in the subject's bedroom.

Hutter HP, Moshammer H, Wallner P, Kundi M. Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations. *Occup Environ Med* (2006); 63(5):307-313.

Austria (2004)



Percentage of subjects reporting symptoms, stratified by RF exposure levels as measured in subject's bedroom.

* = statistically significant for this sample size.

FCC Guidelines: 6000 mW/m²

Hutter HP, Moshammer H, Wallner P, Kundi M. Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations. *Occup Environ Med* (2006); 63(5):307-313.

BACKGROUND: The erection of mobile telephone base stations in inhabited areas has raised concerns about possible health effects caused by emitted microwaves. METHODS: In a cross-sectional study of randomly selected inhabitants living in urban and rural areas for more than one year near to 10 selected base stations, 365 subjects were investigated. Several cognitive tests were performed, and wellbeing and sleep quality were assessed. Field strength of high-frequency electromagnetic fields (HF-EMF) was measured in the bedrooms of 336 households. RESULTS: Total HF-EMF and exposure related to mobile telecommunication were far below recommended levels (max. 4.1 mW/m²). Distance from antennae was 24-600 m in the rural area and 20-250 m in the urban area. Average power density was slightly higher in the rural area (0.05 mW/m²) than in the urban area (0.02 mW/m²). Despite the influence of confounding variables, including fear of adverse effects from exposure to HF-EMF from the base station, there was a significant relation of some symptoms to measured power density; this was highest for headaches. Perceptual speed increased, while accuracy decreased insignificantly with increasing exposure levels. There was no significant effect on sleep quality. CONCLUSION: Despite very low exposure to HF-EMF, effects on wellbeing and performance cannot be ruled out, as shown by recently obtained experimental results; however, mechanisms of action at these low levels are unknown.

Akrotiri, Cyprus (2005)

USCA Case #20-1138

Document #1869762

Filed: 11/04/2020

Page 229 of 481



Evaluation of health concerns near a military radar antenna:

Measurement of average RF levels in two nearby communities:

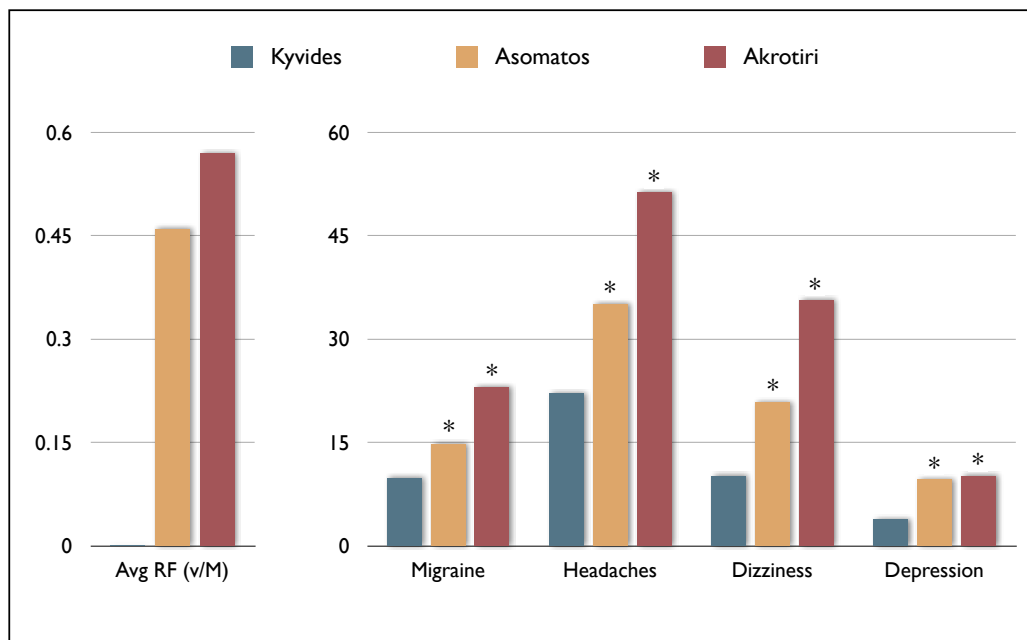
Akrotiri [red circle]

Asomatos [yellow circle]

And as a control, in another village > 20 km distant [blue circle]

Akrotiri also had a cell phone tower.

Preece AW, Georgiou AG, Dunn EJ, Farrow SC. Health response of two communities to military antennae in Cyprus. *Occup Environ Med* (2007); 64(6):402-408.

Akrotiri, Cyprus (2005)

On left, average RF readings in the three communities (in v/m).

On the right, percentages of four reported symptoms were significantly higher in the towns with higher RF exposures.

Average power densities:

Akrotiri: 0.57 v/m = 0.863 $\mu\text{W}/\text{cm}^2$

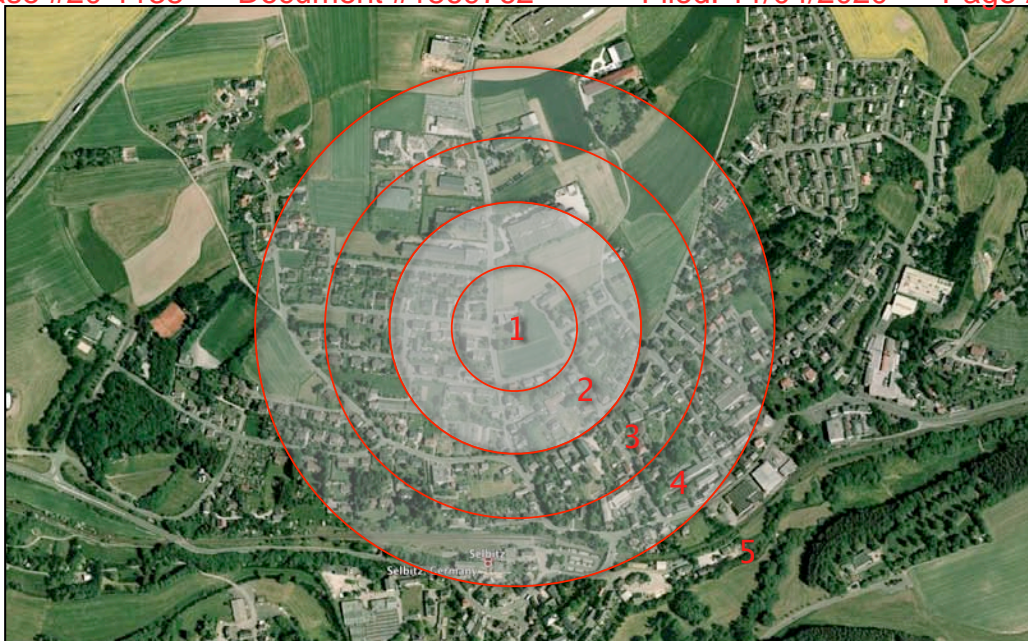
Asomatos: 0.46 v/m = 0.561 $\mu\text{W}/\text{cm}^2$

Pano Kyvides: 0.001 v/m = 0.000001 $\mu\text{W}/\text{cm}^2$

FCC Guidelines: 600–1000 $\mu\text{W}/\text{cm}^2$

Preece AW, Georgiou AG, Dunn EJ, Farrow SC. Health response of two communities to military antennae in Cyprus. *Occup Environ Med* (2007); 64(6):402-408.

Selbitz, Bavaria (2009)



General health survey sent to 1080 residents of the village of Selbitz, Bavaria (population 4644), with 251 responses (23% return).

Two cell tower transmitters in the center of town.

Exposure areas determined by concentric circles of 100 to 400 meters radius.

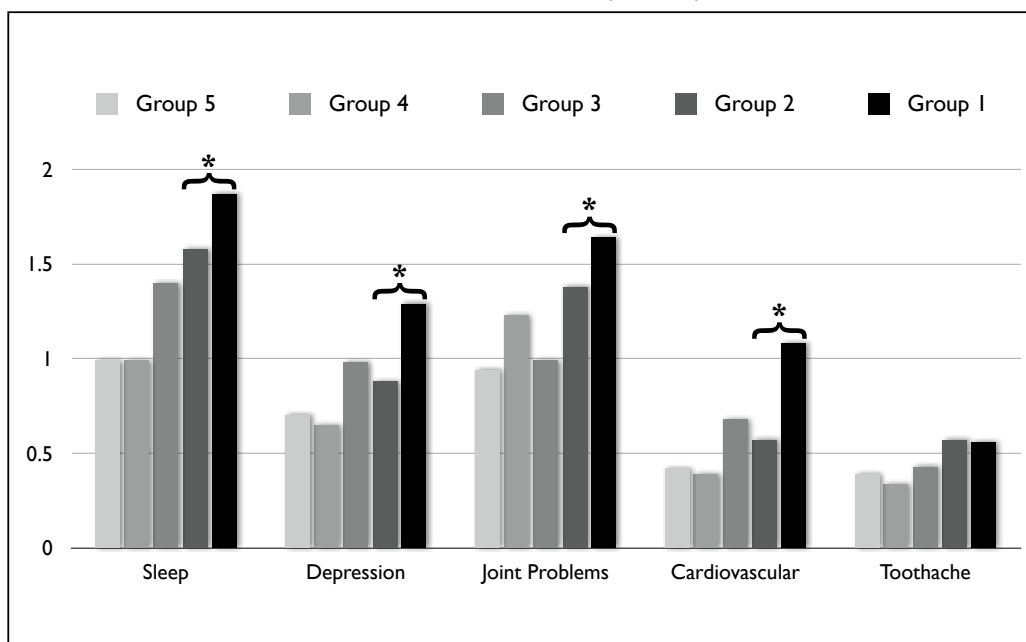
Field measurements stratified exposures into two regions:

Groups 1 and 2 (mean exposure 1.17 V/m)

Groups 3 and 4 (mean exposure 0.70 V/m)

Eger H, Jahn M. Specific Health Symptoms and Cell Phone Radiation in Selbitz (Bavaria, Germany) -- Evidence of a Dose-Response Relationship. *umwelt-medizin-gesellschaft* (2010); 23:1-20.

Selbitz, Bavaria (2009)



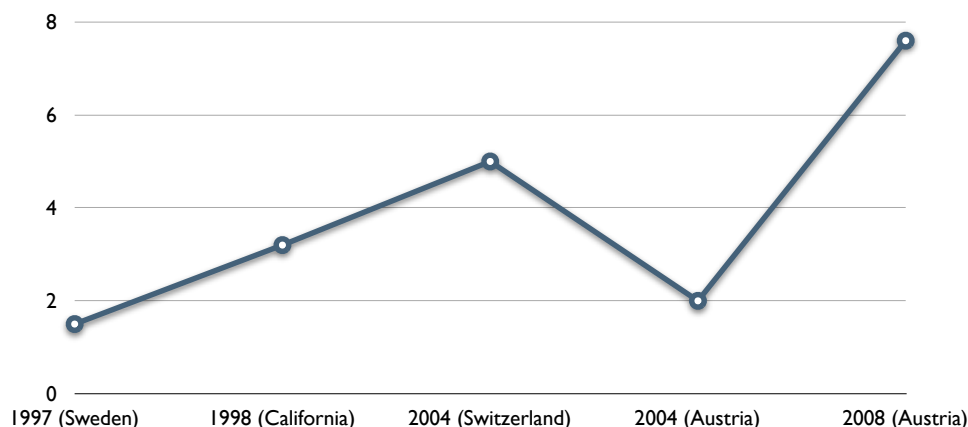
Some sample data from the study. Symptoms scored on 0 - 5 scale.

* = statistically significant (Groups 1 + 2 compared to Groups 3 + 4).

14 of 19 symptom categories showed statistically significant elevations in groups 1 and 2 as compared to groups 3 and 4.

Eger H, Jahn M. Specific Health Symptoms and Cell Phone Radiation in Selbitz (Bavaria, Germany) -- Evidence of a Dose-Response Relationship. *umwelt-medizin-gesellschaft* (2010); 23:1-20.

Incidence of self-identified electrohypersensitivity (%)



In the previous studies, we saw that some symptoms are more common with higher exposure to microwave RF transmissions.

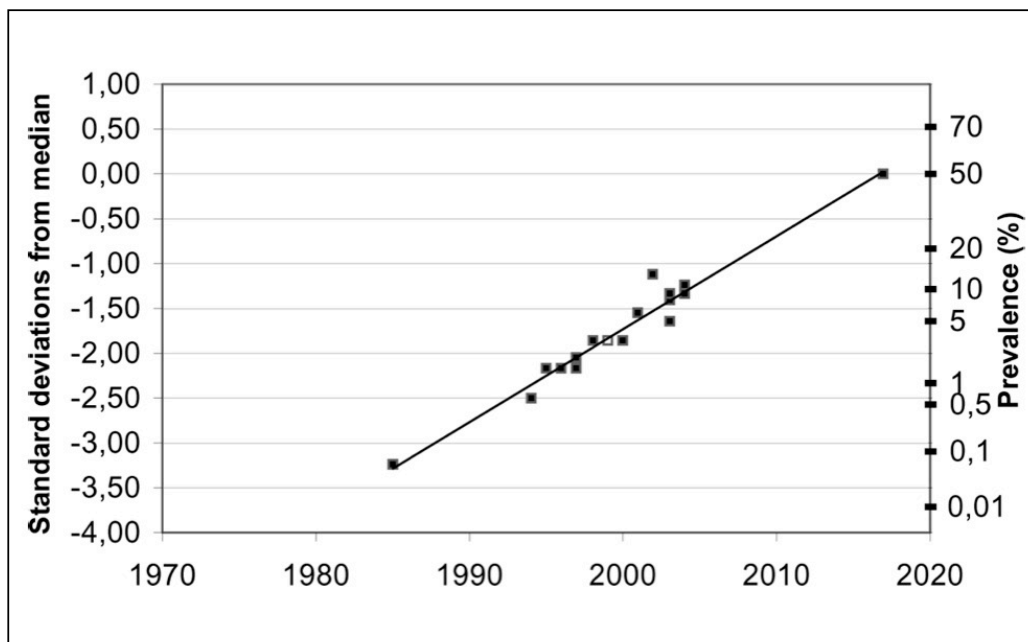
The people who had those symptoms may or may not have been aware that RF was a factor.

But some people with symptoms triggered by microwave RF exposures are aware that this is happening to them.

If these symptoms are sufficiently debilitating, the affected individual may consider themselves to be "electrohypersensitive".

The above graph shows the percentage of the population that self-identified as having "EHS" in surveys done in various countries over the last two decades.

The prevalence of self-reported EHS is increasing.



The prevalence (%) of people around the world who consider themselves to be electrosensitive, as reported in various research studies from 1997 to 2008, plotted over time in a normal distribution graph.

The endpoint at 50% is an extrapolated value.

Hallberg O, Oberfeld G. Letter to the editor: will we all become electrosensitive? *Electromagn Biol Med* (2006); 25(3): 189-191.

Stockholm County, Sweden, 1997: 1.5% of the population reported being hypersensitive to electrical or magnetic fields. (Hillert et al., 2002)

California, 1998: 3.2% of the adult population reported being sensitive to sources of EMF. (Levallois et al., 2002)

Switzerland, 2004: 5% of the population had symptoms attributable to EHS. (Schreier et al., 2006)

Austria, 2004: 2% of the population was estimated to have electrohypersensitivity.

Austria, 2008: 29.3% with some adverse response, 2.1% reported intense disturbance, and 3.5% had experienced enough difficulty that they had consulted a physician about the problem. (Schrottner and Leitgeb, 2008)

Radiation Sickness; Dr. Erica Elliott MD. Comments, Aug. 28, 2013

Erica M. Elliott, M. D.

board certified in family practice and environmental medicine

Received & Inspected

SEP 04 2013

FCC Mail Room

August 28, 2013

Comments on Notice of Inquiry
ET Docket No. 13-84

TO Whom It MAY CONCERN:

As a physician who is treating a Rapidly growing group of patients who have developed disabling radio frequency hypersensitivity, I urge the FCC to make exposure limits more restrictive to avert a national health catastrophe.

Sincerely,

Erica Elliott, MD

Radiation Sickness; Electrohypersensitivity Abstracts; 2017

Electrohypersensitivity Abstracts (December 14, 2017)

Andersson B, Berg M, Arnetz BB, Melin L, Langlet I, Lidén S. A cognitive-behavioral treatment of patients suffering from "electric hypersensitivity". Subjective effects and reactions in a double-blind provocation study. J Occup Environ Med. 38(8):752-758, 1996.

This study tested psychological treatment of patients with "electric hypersensitivity." Seventeen patients were randomly assigned to a treatment group or a waiting-list control group in a pretest-posttest control group design. The patients were also taking part in double-blind provocation tests before and after the treatment. Subjective ratings of symptoms were registered and blood samples were taken and analyzed for "stress-related" variables, such as prolactin, cortisol, dehydroepiandrosterone, and cholesterol levels. The patients in the experimental group reduced their evaluations of the disability more than the control group did. This indicates that psychological treatment may be of value in this disease. However, none of the psychophysiological measures or the subjective reactions to the provocation test showed any significant between-group difference. The conclusion from the provocation test is that this group of alleged hypersensitive patients did not react to the electromagnetic fields.

Andrianome S, Gobert J, Hugueville L, Stéphan-Blanchard E, Telliez F, Selmaoui B. An assessment of the autonomic nervous system in the electrohypersensitive population: a heart rate variability and skin conductance study. J Appl Physiol (1985).123(5):1055-1062, 2017.

The aim of the study was twofold: first, to compare the activity of the autonomic nervous system (ANS) between the population self-declared as electrohypersensitive (EHS) and their matched control individuals without intended exposure to electromagnetic fields (EMF). The second objective was to determine whether acute exposure to different radiofrequency signals modifies ANS activity in EHS. For that purpose, two different experiments were undertaken, in which ANS activity was assessed through heart rate variability (HRV) and skin conductance (SC). In the first experiment, a comparison between the EHS group ($n = 30$) and the control group ($n = 25$) showed that the EHS has an increased number of responses to auditory stimuli as measured by skin conductance activity, and that none of the short-term heart rate variability parameters differ between the two matched study groups. The second experiment, performed in a shielded chamber, involved 10 EHS from the first experiment. The volunteers participated in two different sessions (sham and exposure). The participants were consecutively exposed to four EMF signals (GSM 900, GSM 1800, DECT, and Wi-Fi) at environmental level (1 V/m). The experiment was double blinded and counterbalanced. The HRV variables studied did not differ between the two sessions. Concerning electrodermal activity, the data issued from skin conductance and tonic activity did not differ between the sessions, but showed a time variability. In conclusion, the HRV and SC profiles did not significantly differ between the EHS and control populations under no exposure. Exposure did not have an effect on the ANS parameters we have explored. **NEW & NOTEWORTHY** This study provided analysis on the skin conductance parameters using a newly developed method (peak/min, extraction of skin conductance responses) that had not been performed previously. Additionally, the skin conductance signal was decomposed, considering tonic and phasic activities to be a distinct compound. Moreover, this is the first time a study has been designed into two steps to understand whether the autonomic nervous system is disturbed in the EHS population.

Anttila K. Mycotoxins, fungus and 'electrohypersensitivity'. Med Hypotheses. 55(3):208-214, 2000.

'Electrohypersensitivity' is often explained as a psychological syndrome. Our modern environment contains a lot of different substances and some of them are toxic. Mycotoxins are types of toxins that are biologically very active and that affect living organisms. Mycotoxins and fungi capable of producing toxins have been detected in ventilation systems, water damage and in foodstuff. Many of those displaying symptoms caused by electromagnetic fields have fungus infections or have been living in fungus-contaminated environments for long periods. In animal studies mycotoxins have shown the same effects as those seen in the 'electrohypersensitivity' syndrome. Phototoxic reactions are well known in veterinary medicine and in medical science, so the question is whether the 'electrohypersensitivity' syndrome is caused by 'phototoxic' reactions?

Augner C, Gnambs T, Winker R, Barth A. Acute effects of electromagnetic fields emitted by GSM mobile phones on subjective well-being and physiological reactions: a meta-analysis. Sci Total Environ. 424:11-15, 2012.

The potential effects of radiofrequency electromagnetic fields (RF-EMF) emitted by GSM mobile phones on subjective symptoms, well-being and physiological parameters have been investigated in many studies. However, the results have been ambiguous. The current meta-analysis aims to clarify whether RF-EMF have an influence on well-being in self-reported sensitive persons, as well as in non-sensitive people. A literature search revealed 17 studies including 1174 participants. The single effects for various subjective and objective outcomes were meta-analytically combined to yield a single population parameter. Dependant variables were subjective (e.g. headaches) and objective parameters (e.g. heart rate variability) of well-being. The results show no significant impact of short-term RF-EMF exposure on any parameter. Future research should focus on the possible effects of long-term exposure.

Baliatsas C, van Kamp I, Kelfkens G, Schipper M, Bolte J, Yzermans J, Lebrete E. Non-specific physical symptoms in relation to actual and perceived proximity to mobile phone base stations and powerlines. BMC Public Health. 11:421, 2011.

BACKGROUND: Evidence about a possible causal relationship between non-specific physical symptoms (NSPS) and exposure to electromagnetic fields (EMF) emitted by sources such as mobile phone base stations (BS) and powerlines is insufficient. So far little epidemiological research has been published on the contribution of psychological components to the occurrence of EMF-related NSPS. The prior objective of the current study is to explore the relative importance of actual and perceived proximity to base stations and psychological components as determinants of NSPS, adjusting for demographic, residency and area characteristics.

METHODS: Analysis was performed on data obtained in a cross-sectional study on environment and health in 2006 in the Netherlands. In the current study, 3611 adult respondents (response rate: 37%) in twenty-two Dutch residential areas completed a questionnaire. Self-reported instruments included a symptom checklist and assessment of environmental and psychological characteristics. The computation of the distance between household addresses and location of base stations and powerlines was based on geo-coding. Multilevel regression models were used to test the hypotheses regarding the determinants related to the occurrence of NSPS. **RESULTS:** After adjustment for demographic and residential characteristics, analyses yielded a number of statistically significant associations: Increased report of NSPS

was predominantly predicted by higher levels of self-reported environmental sensitivity; perceived proximity to base stations and powerlines, lower perceived control and increased avoidance (coping) behavior were also associated with NSPS. A trend towards a moderator effect of perceived environmental sensitivity on the relation between perceived proximity to BS and NSPS was verified ($p = 0.055$). There was no significant association between symptom occurrence and actual distance to BS or powerlines. **CONCLUSIONS:** Perceived proximity to BS, psychological components and socio-demographic characteristics are associated with the report of symptomatology. Actual distance to the EMF source did not show up as determinant of NSPS.

Baliatsas C, Van Kamp I, Lebrecht E, Rubin GJ. Idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF): A systematic review of identifying criteria. BMC Public Health. 2012 Aug 11;12:643. doi: 10.1186/1471-2458-12-643.

BACKGROUND: Idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF) remains a complex and unclear phenomenon, often characterized by the report of various, non-specific physical symptoms (NSPS) when an EMF source is present or perceived by the individual. The lack of validated criteria for defining and assessing IEI-EMF affects the quality of the relevant research, hindering not only the comparison or integration of study findings, but also the identification and management of patients by health care providers. The objective of this review was to evaluate and summarize the criteria that previous studies employed to identify IEI-EMF participants. **METHODS:** An extensive literature search was performed for studies published up to June 2011. We searched EMBASE, Medline, Psychinfo, Scopus and Web of Science. Additionally, citation analyses were performed for key papers, reference sections of relevant papers were searched, conference proceedings were examined and a literature database held by the Mobile Phones Research Unit of King's College London was reviewed. **RESULTS:** Sixty-three studies were included. "Hypersensitivity to EMF" was the most frequently used descriptive term. Despite heterogeneity, the criteria predominantly used to identify IEI-EMF individuals were: 1. Self-report of being (hyper)sensitive to EMF. 2. Attribution of NSPS to at least one EMF source. 3. Absence of medical or psychiatric/psychological disorder capable of accounting for these symptoms 4. Symptoms should occur soon (up to 24 hours) after the individual perceives an exposure source or exposed area. (Hyper)sensitivity to EMF was either generalized (attribution to various EMF sources) or source-specific. Experimental studies used a larger number of criteria than those of observational design and performed more frequently a medical examination or interview as prerequisite for inclusion. **CONCLUSIONS:** Considerable heterogeneity exists in the criteria used by the researchers to identify IEI-EMF, due to explicit differences in their conceptual frameworks. Further work is required to produce consensus criteria not only for research purposes but also for use in clinical practice. This could be achieved by the development of an international protocol enabling a clearly defined case definition for IEI-EMF and a validated screening tool, with active involvement of medical practitioners.

Belpomme D, Campagnac C, Irigaray P. Reliable disease biomarkers characterizing and identifying electrohypersensitivity and multiple chemical sensitivity as two etiopathogenic aspects of a unique pathological disorder. Rev Environ Health. 2015 Dec 1;30(4):251-71. doi: 10.1515/reveh-2015-0027.

Much of the controversy over the causes of electro-hypersensitivity (EHS) and multiple chemical sensitivity (MCS) lies in the absence of both recognized clinical criteria and objective biomarkers for widely accepted diagnosis.

Since 2009, we have prospectively investigated, clinically and biologically, 1216 consecutive EHS and/or MCS-self reporting cases, in an attempt to answer both questions. We report here our preliminary data, based on 727 evaluable of 839 enrolled cases: 521 (71.6%) were diagnosed with EHS, 52 (7.2%) with MCS, and 154 (21.2%) with both EHS and MCS. Two out of three patients with EHS and/or MCS were female; mean age (years) was 47. As inflammation appears to be a key process resulting from electromagnetic field (EMF) and/or chemical effects on tissues, and histamine release is potentially a major mediator of inflammation, we systematically measured histamine in the blood of patients. Near 40% had an increase in histaminemia (especially when both conditions were present), indicating a chronic inflammatory response can be detected in these patients. Oxidative stress is part of inflammation and is a key contributor to damage and response. Nitrotyrosin, a marker of both peroxynitrite (ONOO⁻) production and opening of the blood-brain barrier (BBB), was increased in 28% of the cases. Protein S100B, another marker of BBB opening was increased in 15%. Circulating autoantibodies against O-myelin were detected in 23%, indicating EHS and MCS may be associated with autoimmune response. Confirming animal experiments showing the increase of Hsp27 and/or Hsp70 chaperone proteins under the influence of EMF, we found increased Hsp27 and/or Hsp70 in 33% of the patients. As most patients reported chronic insomnia and fatigue, we determined the 24 h urine 6-hydroxymelatonin sulfate (6-OHMS)/creatinin ratio and found it was decreased (<0.8) in all investigated cases. Finally, considering the self-reported symptoms of EHS and MCS, we serially measured the brain blood flow (BBF) in the temporal lobes of each case with pulsed cerebral ultrasound computed tomography. Both disorders were associated with hypoperfusion in the capsulothalamic area, suggesting that the inflammatory process involves the limbic system and the thalamus.

Our data strongly suggest that EHS and MCS can be objectively characterized and routinely diagnosed by commercially available simple tests. Both disorders appear to involve inflammation-related hyper-histaminemia, oxidative stress, autoimmune response, capsulothalamic hypoperfusion and BBB opening, and a deficit in melatonin metabolic availability; suggesting a risk of chronic neurodegenerative disease. Finally the common co-occurrence of EHS and MCS strongly suggests a common pathological mechanism.

Belyaev IY, Hillert L, Protopopova M, Tamm C, Malmgren LO, Persson BR, Selivanova G, Harms-Ringdahl M. 915 MHz microwaves and 50 Hz magnetic field affect chromatin conformation and 53BP1 foci in human lymphocytes from hypersensitive and healthy persons. Bioelectromagnetics. 26(3):173-184, 2005.

We used exposure to microwaves from a global system for mobile communication (GSM) mobile phone (915 MHz, specific absorption rate (SAR) 37 mW/kg) and power frequency magnetic field (50 Hz, 15 µT peak value) to investigate the response of lymphocytes from healthy subjects and from persons reporting hypersensitivity to electromagnetic field (EMF). The

hypersensitive and healthy donors were matched by gender and age and the data were analyzed blind to treatment condition. The changes in chromatin conformation were measured with the method of anomalous viscosity time dependencies (AVTD). 53BP1 protein, which has been shown to colocalize in foci with DNA double strand breaks (DSBs), was analyzed by immunostaining in situ. Exposure at room temperature to either 915 MHz or 50 Hz resulted in significant condensation of chromatin, shown as AVTD changes, which was similar to the effect of heat shock at 41 degrees C. No significant differences in responses between normal and hypersensitive subjects were detected. Neither 915 MHz nor 50 Hz exposure induced 53BP1 foci. On the contrary, a distinct decrease in background level of 53BP1 signaling was observed upon these exposures as well as after heat shock treatments. This decrease correlated with the AVTD data and may indicate decrease in accessibility of 53BP1 to antibodies because of stress-induced chromatin condensation. Apoptosis was determined by morphological changes and by apoptotic fragmentation of DNA as analyzed by pulsed-field gel electrophoresis (PFGE). No apoptosis was induced by exposure to 50 Hz and 915 MHz microwaves. In conclusion, 50 Hz magnetic field and 915 MHz microwaves under specified conditions of exposure induced comparable responses in lymphocytes from healthy and hypersensitive donors that were similar but not identical to stress response induced by heat shock.

Belyaev IY, Markovà E, Hillert L, Malmgren LO, Persson BR. Microwaves from UMTS/GSM mobile phones induce long-lasting inhibition of 53BP1/gamma-H2AX DNA repair foci in human lymphocytes. Bioelectromagnetics 30:129-41, 2009.

We have recently described frequency-dependent effects of mobile phone microwaves (MWs) of global system for mobile communication (GSM) on human lymphocytes from persons reporting hypersensitivity to electromagnetic fields and healthy persons. Contrary to GSM, universal global telecommunications system (UMTS) mobile phones emit wide-band MW signals. Hypothetically, UMTS MWs may result in higher biological effects compared to GSM signal because of eventual "effective" frequencies within the wideband. Here, we report for the first time that UMTS MWs affect chromatin and inhibit formation of DNA double-strand breaks co-localizing 53BP1/gamma-H2AX DNA repair foci in human lymphocytes from hypersensitive and healthy persons and confirm that effects of GSM MWs depend on carrier frequency. Remarkably, the effects of MWs on 53BP1/gamma-H2AX foci persisted up to 72 h following exposure of cells, even longer than the stress response following heat shock. The data are in line with the hypothesis that the type of signal, UMTS MWs, may have higher biological efficiency and possibly larger health risk effects compared to GSM radiation emissions. No significant differences in effects between groups of healthy and hypersensitive subjects were observed, except for the effects of UMTS MWs and GSM-915 MHz MWs on the formation of the DNA repair foci, which were different for hypersensitive ($P < 0.02[53BP1]/0.01[\text{gamma-H2AX}]$) but not for control subjects ($P > 0.05$). The non-parametric statistics used here did not indicate specificity of the differences revealed between the effects of GSM and UMTS MWs on cells from hypersensitive subjects and more data are needed to study the nature of these differences.

Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Kern M, Kundi M, Moshammer H, Lercher P, Müller K, Oberfeld G, Ohnsorge P, Pelzmann P, Scheingraber C, Thill R. EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses. Rev Environ Health. Publ online 2016 Jul 25. doi: 10.1515/reveh-2016-0011.

Chronic diseases and illnesses associated with unspecific symptoms are on the rise. In addition to chronic stress in social and work environments, physical and chemical exposures at home, at work, and during leisure activities are causal or contributing environmental stressors that

deserve attention by the general practitioner as well as by all other members of the health care community. It seems certainly necessary now to take "new exposures" like electromagnetic field (EMF) into account. Physicians are increasingly confronted with health problems from unidentified causes.

Studies, empirical observations, and patient reports clearly indicate interactions between EMF exposure and health problems. Individual susceptibility and environmental factors are frequently neglected. New wireless technologies and applications have been introduced without any certainty about their health effects, raising new challenges for medicine and society. For instance, the issue of so-called non-thermal effects and potential long-term effects of low-dose exposure were scarcely investigated prior to the introduction of these technologies. Common EMF sources include Wi-Fi access points, routers and clients, cordless and mobile phones including their base stations, Bluetooth devices, ELF magnetic fields from net currents, ELF electric fields from electric lamps and wiring close to the bed and office desk. On the one hand, there is strong evidence that long-term-exposure to certain EMF exposures is a risk factor for diseases such as certain cancers, Alzheimer's disease and male infertility. On the other hand, the emerging electromagnetic hypersensitivity (EHS) is more and more recognized by health authorities, disability administrators and case workers, politicians, as well as courts of law.

We recommend treating EHS clinically as part of the group of chronic multisystem illnesses (CMI) leading to a functional impairment (EHS), but still recognizing that the underlying cause remains the environment. In the beginning, EHS symptoms often occur only occasionally, but over time they may increase in frequency and severity. Common EHS symptoms include headaches, concentration difficulties, sleeping problems, depression, lack of energy, fatigue and flu-like symptoms.

A comprehensive medical history, which should include all symptoms and their occurrences in spatial and temporal terms and in the context of EMF exposures, is the key to the diagnosis. The EMF exposure can be assessed by asking for typical sources like Wi-Fi access points, routers and clients, cordless and mobile phones and measurements at home and at work. It is very important to take the individual susceptibility into account.

The primary method of treatment should mainly focus on the prevention or reduction of EMF exposure, that is, reducing or eliminating all sources of EMF at home and in the workplace. The reduction of EMF exposure should also be extended to public spaces such as schools, hospitals, public transport, and libraries to enable persons with EHS an unhindered use (accessibility measure). If a detrimental EMF exposure is reduced sufficiently, the body has a chance to recover and EHS symptoms will be reduced or even disappear. Many examples have shown that such measures can prove effective. Also the survival rate of children with leukemia depends on ELF magnetic field exposure at home.

To increase the effectiveness of the treatment, the broad range of other environmental factors that contribute to the total body burden should also be addressed. Anything that supports a balanced homeostasis will increase a person's resilience against disease and thus against the adverse effects of EMF exposure. There is increasing evidence that EMF exposure has a major impact on the oxidative and nitrosative regulation capacity in affected individuals. This concept also may explain why the level of susceptibility to EMF can change and why the number of symptoms reported in the context of EMF exposures is so large. Based on our current understanding, a treatment approach that minimizes the adverse effects of peroxynitrite - as has been increasingly used in the treatment of multisystem disorders - works best.

This EMF Guideline gives an overview of the current knowledge regarding EMF-related health risks and provides concepts for the diagnosis and treatment and accessibility measures of EHS to improve and restore individual health outcomes as well as for the development of strategies for prevention.

Bensefa-Colas L, Dupas D. [Idiopathic environmental intolerance: 2 disabling entities to recognize]. Rev Prat. 64(3):358-362, 2014. [Article in French]

Idiopathic environmental intolerance is characterized by a variety of non-specific symptoms involving several organs within the same individual, and attributed to the exposure to chemical odors (multiple chemical sensitivities) or to the exposure to electromagnetic fields (electromagnetic hypersensitivity). Symptoms occur following an exposure to agents generally regarded as harmless due to the low levels of exposure, and they do not answer to any definition of organic diseases. The lack of established etiology renders treatment difficult. It is important for practitioner to recognize such disorders and assess the social and professional impact so as to improve patients' quality of life.

Bergdahl J, Tillberg A, Stenman E. Odontologic survey of referred patients with symptoms allegedly caused by electricity or visual display units. Acta Odontol Scand. 56(5):303-307, 1998.

Twenty-eight consecutive patients with symptoms allegedly caused by electricity or visual display units were odontologically investigated according to a specially designed registration form including an anamnestic interview and a clinical protocol. The most common oral and general symptoms reported were burning mouth, craniomandibular dysfunction symptoms, skin complaints, and fatigue. Oral symptoms such as craniomandibular dysfunction and general symptoms such as eye complaints and dizziness scored highest on a visual analog scale regarding mean symptom intensity. The patients reported various numbers of medical diagnoses, such as allergic rhinitis or asthma and hypothyroidism. Various dental diseases were found; the most common were temporomandibular joint and masticatory muscle dysfunctions, lesions in the oral mucosa, and periodontal diseases. Urinary-Hg (U-Hg) analysis showed a mean U-Hg concentration of 8.5 nmol Hg/L urine, and none of the patients exceeded the limit of 50 nmol Hg/L urine. The U-Hg concentration was positively correlated with the number of amalgam fillings ($P < 0.01$) and craniomandibular disorders ($P < 0.05$). No or low secretion of the minor mucous glands was found in 43% of the patients. One patient showed hypersensitivity to gold and cobalt. The present study showed that various odontologic factors might be involved in some of these patients' suffering. Thus, it is important that professionals from other disciplines collaborate with dentistry if these patients are to be properly investigated.

Blettner M, Schlehofer B, Breckenkamp J, Kowall B, Schmiedel S, Reis U, Potthoff P, Schüz J, Berg-Beckhoff G. Mobile phone base stations and adverse health effects: phase 1 of a population-based, cross-sectional study in Germany. Occup Environ Med. 66(2):118-123, 2009.

OBJECTIVE: The aim of this first phase of a cross-sectional study from Germany was to investigate whether proximity of residence to mobile phone base stations as well as risk perception is associated with health complaints. **METHODS:** The researchers conducted a population-based, multi-phase, cross-sectional study within the context of a large panel survey regularly carried out by a private research institute in Germany. In the initial phase, reported on in this paper, 30,047 persons from a total of 51,444 who took part in the nationwide survey also

answered questions on how mobile phone base stations affected their health. A list of 38 health complaints was used. A multiple linear regression model was used to identify predictors of health complaints including proximity of residence to mobile phone base stations and risk perception. **RESULTS:** Of the 30,047 participants (response rate 58.6%), 18.7% of participants were concerned about adverse health effects of mobile phone base stations, while an additional 10.3% attributed their personal adverse health effects to the exposure from them. Participants who were concerned about or attributed adverse health effects to mobile phone base stations and those living in the vicinity of a mobile phone base station (500 m) reported slightly more health complaints than others. **CONCLUSIONS:** A substantial proportion of the German population is concerned about adverse health effects caused by exposure from mobile phone base stations. The observed slightly higher prevalence of health complaints near base stations can not however be fully explained by attributions or concerns.

Bortkiewicz A, Zmyslony M, Szyjowska A, Gadzicka E. [Subjective symptoms reported by people living in the vicinity of cellular phone base stations: review]. Med Pr. 55(4):345-351, 2004. [Article in Polish]

The problem of health effects of electromagnetic fields (EMF) emitted by cellular phone base stations evokes much interest in view of the fact that people living in their vicinity are fated to continuous exposure to EMF. None of the studies carried out throughout the world have revealed excessive values of standards adopted by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). A questionnaire was used as a study tool. The results of the questionnaire survey reveal that people living in the vicinity of base stations report various complaints mostly of the circulatory system, but also of sleep disturbances, irritability, depression, blurred vision, concentration difficulties, nausea, lack of appetite, headache and vertigo. The performed studies showed the relationship between the incidence of individual symptoms, the level of exposure, and the distance between a residential area and a base station. This association was observed in both groups of persons, those who linked their complaints with the presence of the base station and those who did not notice such a relation. Further studies, clinical and those based on questionnaires, are needed to explain the background of reported complaints.

Carpenter DO. Excessive exposure to radiofrequency electromagnetic fields may cause the development of electrohypersensitivity. Altern Ther Health Med. 20(6):40-42, 2014. (no abstract available)

Carpenter DO. The microwave syndrome or electro-hypersensitivity: historical background. Rev Environ Health. 2015 Nov 10. doi: 10.1515/reveh-2015-0016. [Epub ahead of print]

Microwave generating equipment first became common during World War 2 with the development of radar. Soviet bloc countries reported that individuals exposed to microwaves frequently developed headaches, fatigue, loss of appetite, sleepiness, difficulty in concentration, poor memory, emotional instability, and labile cardiovascular function, and established stringent exposure standards. For a variety of reasons these reports were discounted in Western countries, where the prevailing belief was that there could be no adverse health effects of electromagnetic fields (EMFs) that were not mediated by tissue heating. The reported Soviet effects were at lower intensities than those that cause heating. However, there were several accidental exposures of radar operators in Western countries that resulted in persistent symptoms similar to those described above. The Soviets irradiated the US Embassy in Moscow with microwaves during the period 1953-1975, and while no convincing evidence of elevated

cancer rates was reported, there were reports of "microwave illness." Officials passed these complaints off as being due to anxiety, not effects of the microwave exposure. There is increasing evidence that the "microwave syndrome" or "electro-hypersensitivity" (EHS) is a real disease that is caused by exposure to EMFs, especially those in the microwave range. The reported incidence of the syndrome is increasing along with increasing exposure to EMFs from electricity, WiFi, mobile phones and towers, smart meters and many other wireless devices. Why some individuals are more sensitive is unclear. While most individuals who report having EHS do not have a specific history of an acute exposure, excessive exposure to EMFs, even for a brief period of time, can induce the syndrome.

Dahmen N, Ghezel-Ahmadi D, Engel A. Blood laboratory findings in patients suffering from self-perceived electromagnetic hypersensitivity (EHS). Bioelectromagnetics. 30(4):299-306, 2009.

Risks from electromagnetic devices are of considerable concern. Electrohypersensitive (EHS) persons attribute a variety of rather unspecific symptoms to exposure to electromagnetic fields. The pathophysiology of EHS is unknown and therapy remains a challenge. We hypothesized that some electrosensitive individuals are suffering from common somatic health problems. Toward this end we analysed clinical laboratory parameters including thyroid-stimulating hormone (TSH), alanine transaminase (ALT), aspartate transaminase (AST), creatinine, hemoglobine, hematocrit and c-reactive protein (CRP) in subjects suffering from EHS and in controls that are routinely used in clinical medicine to identify or screen for common somatic disorders. One hundred thirty-two patients (n = 42 males and n = 90 females) and 101 controls (n = 34 males and n = 67 females) were recruited. Our results identified laboratory signs of thyroid dysfunction, liver dysfunction and chronic inflammatory processes in small but remarkable fractions of EHS sufferers as potential sources of symptoms that merit further investigation in future studies. In the cases of TSH and ALT/AST there were significant differences between cases and controls. The hypotheses of anaemia or kidney dysfunction playing a major role in EHS could be unambiguously refuted. Clinically it is recommended to check for signs of treatable somatic conditions when caring for individuals suffering from self-proclaimed EHS.

De Luca et al 2014. Metabolic and Genetic Screening of Electromagnetic Hypersensitive Subjects as a Feasible Tool for Diagnostics and Intervention. Mediators of Inflammation. Volume 2014, Article ID 924184. Open

Access <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4000647/pdf/MI2014-924184.pdf>

Study of self-reported hypersensitivity to electromagnetic fields in California

Dieudonné M. Does electromagnetic hypersensitivity originate from nocebo responses? Indications from a qualitative study. Bioelectromagnetics. 2015 Sep 15. doi: 10.1002/bem.21937. [Epub ahead of print]

Idiopathic Environmental Intolerance attributed to Electromagnetic Fields (IEI-EMF) is a condition in which symptoms are attributed to electromagnetic field (EMF) exposure. As electro-hypersensitive (EHS) people have repeatedly been observed, during provocation trials, to report symptoms following perceived rather than actual exposure, the hypothesis has been put forward that IEI-EMF originates from psychological mechanisms, especially nocebo responses. This paper examines this hypothesis, using data from a qualitative study aimed at understanding how EHS people come to regard themselves as such.

Forty self-diagnosed EHS people were interviewed.

A typified model of their attribution process was then elaborated, inductively, from their narratives. This model is linear and composed of seven stages: (1) onset of symptoms; (2) failure to find a solution; (3) discovery of EHS; (4) gathering of information about EHS; (5) implicit appearance of conviction; (6) experimentation; (7) conscious acceptance of conviction.

Overall, symptoms appear before subjects start questioning effects of EMF on their health, which is not consistent with the hypothesis that IEI-EMF originates from nocebo responses to perceived EMF exposure. However, such responses might occur at the sixth stage of the process, potentially reinforcing the attribution. It remains possible that some cases of IEI-EMF originate from other psychological mechanisms.

Dömötör Z, Szemerszky R, Köteles F. Nature relatedness is connected with modern health worries and electromagnetic hypersensitivity. J Health Psychol. 2017 Mar 1;1359105317699681. doi: 10.1177/1359105317699681.

Although nature relatedness is considered a positive characteristic, its relationship to constructs involving worries about the negative effects of artificial environmental factors is also feasible. A questionnaire assessing modern health worries, electrosensitivity, somatosensory amplification, spirituality, and nature relatedness was completed by 510 individuals. Nature relatedness was related to electrosensitivity, modern health worries, and spirituality. In a binary logistic regression analysis, somatosensory amplification, modern health worries, and nature relatedness were associated with electrosensitivity, and nature relatedness moderated the connection between modern health worries and electrosensitivity. In naive representations, "natural" might be associated with health, whereas "modern" and "artificial" evoke negative associations. <https://www.ncbi.nlm.nih.gov/pubmed/28810440>

Eltiti S, Wallace D, Zougkou K, Russo R, Joseph S, Rasor P, Fox E. Development and evaluation of the electromagnetic hypersensitivity questionnaire. Bioelectromagnetics. 28(2):137-151, 2007.

Electromagnetic hypersensitivity (EHS) syndrome is usually defined as a condition where an individual experiences adverse health effects that he or she believes is due to exposure to objects that emit electromagnetic fields. The aim of this study was to develop a questionnaire that would identify the key symptoms associated with EHS and determine how often these symptoms occur in the general population of the United Kingdom. In the pilot study, an EHS questionnaire was developed and tested. In Study 1 the EHS questionnaire was revised and sent to a randomly selected sample of 20,000 people. Principal components analysis of the symptoms resulted in eight subscales: neurovegetative, skin, auditory, headache, cardiorespiratory, cold related, locomotor, and allergy related symptoms. Study 2 established the validity of the questionnaire in that EHS individuals showed a higher severity of symptoms on all subscales compared to the control group. The two key results of this study were the development of a scale that provides an index of the type and intensity of symptoms commonly experienced by people believing themselves to be EHS and a screening tool that researchers can use to pre-select the most sensitive individuals to take part in their research.

Eltiti S, Wallace D, Ridgewell A, Zougkou K, Russo R, Sepulveda F, Mirshekar-Syahkal D, Rasor P, Deeble R, Fox E. Does short-term exposure to mobile phone base station signals increase symptoms in individuals who report sensitivity to electromagnetic fields? A double-blind randomized provocation study. Environ Health Perspect. 115(11):1603-1608, 2007.

BACKGROUND: Individuals with idiopathic environmental illness with attribution to electromagnetic fields (IEI-EMF) believe they suffer negative health effects when exposed to electromagnetic fields from everyday objects such as mobile phone base stations. OBJECTIVES: This study used both open provocation and double-blind tests to determine if sensitive and control individuals experience more negative health effects when exposed to base station-like signals compared with sham. METHODS: Fifty-six self-reported sensitive and 120 control participants were tested in an open provocation test. Of these, 12 sensitive and 6 controls withdrew after the first session. The remainder completed a series of double-blind tests. Subjective measures of well-being and symptoms as well as physiological measures of blood volume pulse, heart rate, and skin conductance were obtained. RESULTS: During the open provocation, sensitive individuals reported lower levels of well-being in both the global system for mobile communication (GSM) and universal mobile telecommunications system (UMTS) compared with sham exposure, whereas controls reported more symptoms during the UMTS exposure. During double-blind tests the GSM signal did not have any effect on either group. Sensitive participants did report elevated levels of arousal during the UMTS condition, whereas the number or severity of symptoms experienced did not increase. Physiological measures did not differ across the three exposure conditions for either group. CONCLUSIONS: Short-term exposure to a typical GSM base station-like signal did not affect well-being or physiological functions in sensitive or control individuals. Sensitive individuals reported elevated levels of arousal when exposed to a UMTS signal. Further analysis, however, indicated that this difference was likely to be due to the effect of order of exposure rather than the exposure itself.

Eltiti S, Wallace D, Ridgewell A, Zougkou K, Russo R, Sepulveda F, Fox E. Short-term exposure to mobile phone base station signals does not affect cognitive functioning or physiological measures in individuals who report sensitivity to electromagnetic fields and controls. Bioelectromagnetics. 30(7):556-563, 2009.

Individuals who report sensitivity to electromagnetic fields often report cognitive impairments that they believe are due to exposure to mobile phone technology. Previous research in this area has revealed mixed results, however, with the majority of research only testing control individuals. Two studies using control and self-reported sensitive participants found inconsistent effects of mobile phone base stations on cognitive functioning. The aim of the present study was to clarify whether short-term (50 min) exposure at 10 mW/m² to typical Global System for Mobile Communication (GSM) and Universal Mobile Telecommunications System (UMTS) base station signals affects attention, memory, and physiological endpoints in sensitive and control participants. Data from 44 sensitive and 44 matched-control participants who performed the digit symbol substitution task (DSST), digit span task (DS), and a mental arithmetic task (MA), while being exposed to GSM, UMTS, and sham signals under double-blind conditions were analyzed. Overall, cognitive functioning was not affected by short-term exposure to either GSM or UMTS signals in the current study. Nor did exposure affect the physiological measurements of blood volume pulse (BVP), heart rate (HR), and skin conductance (SC) that were taken while participants performed the cognitive tasks.

Flodin U, Seneby A, Tegenfeldt C. Provocation of electric hypersensitivity under everyday conditions. Scand J Work Environ Health. 26(2):93-98, 2000.

OBJECTIVES: In most previous provocation studies subjects suffering from "electric hypersensitivity" have not been able to determine correctly whether or not they have been subjected to a sham or true provocation to magnetic or electric fields. However, an often-discussed weakness is that most of the earlier provocation studies have been performed in a laboratory situation, often with simulated fields, which may not be representative of conditions prevailing in the homes or workplaces of the patients. Criticism has also been put forth about neglect of the long latency period of symptoms. Therefore, a provocation study was performed in the homes or workplaces of the patients, where we also studied the symptoms and on-off answer 24 hours after the exposure. **METHODS:** Fifteen subjects selected as having fast and distinct reactions from electric equipment were provoked on 4 occasions: mainly 2 true and 2 sham provocations. The intervals between exposure were a few or more days in order to provide the subjects with an opportunity to recover before the next provocation. A control group of healthy subjects with normal hearing and vision verified that the provocations were performed in a blind manner. **RESULTS:** The patients suffering from "electric hypersensitivity" were no better than the control group in deciding whether or not they were exposed to electric and magnetic fields. **CONCLUSIONS:** Exposure to electric and magnetic fields per se does not seem to be a sufficient cause of the symptoms experienced by this patient group.

Frei P, Mohler E, Braun-Fahrländer C, Fröhlich J, Neubauer G, Rösli M; QUALIFEX-team. Cohort study on the effects of everyday life radio frequency electromagnetic field exposure on non-specific symptoms and tinnitus. Environ Int. 38(1):29-36, 2012.

BACKGROUND: There is public concern regarding potential health effects of radio frequency electromagnetic fields (RF-EMF) exposure, as produced by mobile phones or broadcast transmitters. The objective of this study was to investigate the association between RF-EMF exposure and non-specific symptoms and tinnitus in a prospective cohort study. **METHODS:** In 2008, 1375 randomly selected participants from Basel, Switzerland, were enrolled in a questionnaire survey with follow-up after one year (participation rate 82%). A score for somatic complaints (von Zerssen list) and headache (HIT-6) was assessed. Far-field environmental RF-EMF exposure was predicted using a validated prediction model. Regarding near-field exposure, self-reported mobile and cordless phone use as well as mobile phone operator data were collected. In multivariate regression models, we investigated whether exposure at baseline (cohort analysis) or changes in exposure between baseline and follow-up (change analysis) were related to changes in health scores. **RESULTS:** For participants in the top decile of environmental far-field RF-EMF exposure at baseline, in comparison to participants exposed below the median value, the change in the von Zerssen- and HIT-6-scores between baseline and follow-up was -0.12 (95%-CI: -1.79 to 1.56) and -0.37 (95%-CI: -1.80 to 1.07) units, respectively. Exposure to near-field sources and a change in exposure between baseline and follow-up were not related to non-specific symptoms. Similarly, no association between RF-EMF exposure and tinnitus was observed. **CONCLUSIONS:** In this first cohort study using objective and well-validated RF-EMF exposure measures, we did not observe an association between RF-EMF exposure and non-specific symptoms or tinnitus.

Frick U, Rehm J, Eichhammer P. Risk perception, somatization, and self report of complaints related to electromagnetic fields--a randomized survey study. Int J Hyg Environ Health. 205(5):353-360, 2002.

Exposure to electromagnetic fields (EMF) as well as EMF-related complaints has increased over the past decades. However, it is unclear whether these complaints are related to the

electromagnetic or other physical properties of these fields per se, to salience of EMF in media, or to both. What is the prevalence of EMF-related complaints in the general population? What are the influencing factors on this prevalence? Does reporting of EMF-related symptoms depend on cognitive factors? To answer these questions, a survey with random variation of three cognitive factors was performed. As expected, EMF-related complaints were reported more by females and people with higher somatization tendency. Age had no significant linear effect on EMF-related complaints. The cognitive condition of threat produced a significant contrast effect among people with high somatization tendency on EMF-related complaints. Cognition can influence reporting of EMF-related effects. Thus, in future research of such effects, psychologically influencing factors should be included. Also risk communication should incorporate knowledge about social cognition.

Frick U, Kharraz A, Hauser S, Wiegand R, Rehm J, Kovatsits U, Eichhammer P. Comparison perception of singular transcranial magnetic stimuli by subjectively electrosensitive subjects and general population controls. Bioelectromagnetics. 26(4):287-298, 2005.

Transcranial magnetic stimulation of the dorsolateral prefrontal cortex by single pulses of varying field intensities was used to measure thresholds of individual perception and motor response in three groups of subjects: subjectively electrosensitive people, general population controls with a high burden of complaints related to electromagnetic field (EMF) exposure in the literature (highest decile in complaint burden), and general population controls with a low burden of complaints (lowest decile in complaint burden). The major study endpoint was the ability of the subjects to differentiate between real magnetic stimulation and a sham condition. There were no significant differences between groups in the thresholds, neither of detecting the real magnetic stimulus nor in motor response. But the three groups differed significantly in differentiating between stimulation and sham condition, with the subjectively electrosensitive people having the lowest ability to differentiate and the control group with high level of EMF-related complaints having the best ability to differentiate. Differences between groups were mostly due to false alarm reactions in the sham condition reported by subjectively electrosensitives (SES). We found no objective correlate of the self perception of being "electrosensitive." Overall, our experiment does not support the hypothesis that subjectively electrosensitive patients suffer from a physiological hypersensitivity to EMFs or stimuli. Further research should focus on disposing factors explaining the unspecific sensory hyperresponsiveness of subjectively electrosensitive subjects.

Furubayashi T, Ushiyama A, Terao Y, Mizuno Y, Shirasawa K, Pongpaibool P, Simba AY, Wake K, Nishikawa M, Miyawaki K, Yasuda A, Uchiyama M, Yamashita HK, Masuda H, Hirota S, Takahashi M, Okano T, Inomata-Terada S, Sokejima S, Maruyama E, Watanabe S, Taki M, Ohkubo C, Ugawa Y. Effects of short-term W-CDMA mobile phone base station exposure on women with or without mobile phone related symptoms. Bioelectromagnetics. 30(2):100-113, 2009.

To investigate possible health effects of mobile phone use, we conducted a double-blind, cross-over provocation study to confirm whether subjects with mobile phone related symptoms (MPRS) are more susceptible than control subjects to the effect of electromagnetic fields (EMF) emitted from base stations. We sent questionnaires to 5,000 women and obtained 2,472 valid responses from possible candidates; from these, we recruited 11 subjects with MPRS and 43 controls. There were four EMF exposure conditions, each of which lasted 30 min: continuous, intermittent, and sham exposure with and without noise. Subjects were exposed to EMF of 2.14

GHz, 10 V/m (W-CDMA), in a shielded room to simulate whole-body exposure to EMF from base stations, although the exposure strength we used was higher than that commonly received from base stations. We measured several psychological and cognitive parameters pre- and post-exposure, and monitored autonomic functions. Subjects were asked to report on their perception of EMF and level of discomfort during the experiment. The MPRS group did not differ from the controls in their ability to detect exposure to EMF; nevertheless they consistently experienced more discomfort, regardless of whether or not they were actually exposed to EMF, and despite the lack of significant changes in their autonomic functions. Thus, the two groups did not differ in their responses to real or sham EMF exposure according to any psychological, cognitive or autonomic assessment. In conclusion, we found no evidence of any causal link between hypersensitivity symptoms and exposure to EMF from base stations.

Gangi S, Johansson O. Skin changes in "screen dermatitis" versus classical UV- and ionizing irradiation-related damage--similarities and differences. *Exp Dermatol.* 6(6):283-291, 1997.

An increasing number of persons say that they get cutaneous problems as well as symptoms from certain internal organs, such as the central nervous system (CNS) and the heart, when being close to electric equipment. A major group of these patients are the users of video display terminals (VDTs), who claim to have subjective and objective skin- and mucosa-related symptoms, such as pain, itch, heat sensation, erythema, papules, and pustules. The CNS symptoms are, e.g. dizziness, tiredness, and headache. Erythema, itch, heat sensation, edema and pain are also common symptoms of sunburn (UV dermatitis). Alterations have been observed in cell populations of the skin of patients suffering from so-called "screen dermatitis" similar to those observed in the skin damaged due to ultraviolet (UV) light or ionizing radiation. In "screen dermatitis" patients a much higher number of mast cells have been observed. It is known that UVB irradiation induces mast cell degranulation and release of TNF-alpha. The high number of mast cells present in the "screen dermatitis" patients and the possible release of specific substances, such as histamine, may explain their clinical symptoms of itch, pain, edema and erythema. The most remarkable change among cutaneous cells, after exposure with the above-mentioned irradiation sources, is the disappearance of the Langerhans' cells. This change has also been observed in "screen dermatitis" patients, again pointing to a common cellular and molecular basis. The results of this literature study demonstrate that highly similar changes exist in the skin of "screen dermatitis" patients, as regards the clinical manifestations as well as alterations in the cell populations, and in skin damaged by UV light or ionizing radiation.

Gangi S, Johansson O. A theoretical model based upon mast cells and histamine to explain the recently proclaimed sensitivity to electric and/or magnetic fields in humans. *Med Hypotheses.* 54(4):663-671, 2000.

The relationship between exposure to electromagnetic fields (EMFs) and human health is more and more in focus. This is mainly because of the rapid increasing use of such EMFs within our modern society. Exposure to EMFs has been linked to different cancer forms, e.g. leukemia, brain tumors, neurological diseases, such as Alzheimer's disease, asthma and allergy, and recently to the phenomena of 'electrosensitivity' and 'screen dermatitis'. There is an increasing number of reports about cutaneous problems as well as symptoms from internal organs, such as the heart, in people exposed to video display terminals (VDTs). These people suffer from subjective and objective skin and mucosa-related symptoms, such as itch, heat sensation, pain, erythema, papules and pustules. In severe cases, people can not, for instance,

use VDTs or artificial light at all, or be close to mobile telephones. Mast cells (MCs), when activated, release a spectrum of mediators, among them histamine, which is involved in a variety of biological effects with clinical relevance, e.g. allergic hypersensitivity, itch, edema, local erythema and many types of dermatoses. From the results of recent studies, it is clear that EMFs affect the MC, and also the dendritic cell, population and may degranulate these cells. The release of inflammatory substances, such as histamine, from MCs in the skin results in a local erythema, edema and sensation of itch and pain, and the release of somatostatin from the dendritic cells may give rise to subjective sensations of on-going inflammation and sensitivity to ordinary light. These are, as mentioned, the common symptoms reported from patients suffering from 'electrosensitivity'/'screen dermatitis'. MCs are also present in the heart tissue and their localization is of particular relevance to their function. Data from studies made on interactions of EMFs with the cardiac function have demonstrated that highly interesting changes are present in the heart after exposure to EMFs. One could speculate that the cardiac MCs are responsible for these changes due to degranulation after exposure to EMFs. However, it is still not known how, and through which mechanisms, all these different cells are affected by EMFs. In this article, we present a theoretical model, based upon observations on EMFs and their cellular effects, to explain the proclaimed sensitivity to electric and/or magnetic fields in humans.

Genuis SJ, Lipp CT. Electromagnetic hypersensitivity: fact or fiction? Sci Total Environ. 414:103-112, 2012.

As the prevalence of wireless telecommunication escalates throughout the world, health professionals are faced with the challenge of patients who report symptoms they claim are connected with exposure to some frequencies of electromagnetic radiation (EMR). Some scientists and clinicians acknowledge the phenomenon of hypersensitivity to EMR resulting from common exposures such as wireless systems and electrical devices in the home or workplace; others suggest that electromagnetic hypersensitivity (EHS) is psychosomatic or fictitious. Various organizations including the World Health Organization as well as some nation states are carefully exploring this clinical phenomenon in order to better explain the rising prevalence of non-specific, multi-system, often debilitating symptoms associated with non-ionizing EMR exposure. As well as an assortment of physiological complaints, patients diagnosed with EHS also report profound social and personal challenges, impairing their ability to function normally in society. This paper offers a review of the sparse literature on this perplexing condition and a discussion of the controversy surrounding the legitimacy of the EHS diagnosis. Recommendations are provided to assist health professionals in caring for individuals complaining of EHS.

Ghezel-Ahmadi D, Engel A, Weidemann J, Budnik LT, Baur X, Frick U, Hauser S, Dahmen N. Heavy metal exposure in patients suffering from electromagnetic hypersensitivity. Sci Total Environ. 408(4):774-778, 2010.

BACKGROUND: Risks from electromagnetic devices are of considerable concern. Electrohypersensitive (EHS) persons attribute a variety of rather unspecific symptoms to the exposure to electromagnetic fields. The pathophysiology of EHS is unknown and therapy remains a challenge. **OBJECTIVES:** Heavy metal load has been discussed as a potential factor in the symptomatology of EHS patients. The main objective of the study was to test the hypothesis of a link between EHS and heavy metal exposure. **METHODS:** We measured lead, mercury and cadmium concentrations in the blood of 132 patients (n=42 males and n=90 females) and 101 controls (n=34 males and n=67 females). **RESULTS:** Our results show that

heavy metal load is of no concern in most cases of EHS but might play a role in exceptional cases. **CONCLUSIONS:** The data do not support the general advice to heavy metal detoxification in EHS.

Gibson PR, Kovach S, Lupfer A. Unmet health care needs for persons with environmental sensitivity. J Multidiscip Healthc. 8:59-66, 2015.

Studies of unmet health care needs have shown that women, people with poor health, and people with lower socioeconomic status are more likely to report having unmet health care needs. In this study, we examined the types of and reasons for unmet health care needs in 465 people with environmental sensitivities. A second area of inquiry involved negative reactions to general anesthesia. Results showed that the most common barriers to receiving care were the inability to find a provider who understands environmental sensitivities and a lack of accessibility due to chemical and electromagnetic exposures in health care environments. Lower income and poorer health (longer illness, a worsening or fluctuating course of illness, and a higher level of disability) were significantly correlated with the total number of reported unmet health care needs. Some people with environmental sensitivities reported having negative reactions to anesthesia of long duration; most common were nausea and vomiting, fatigue, and reduced cognitive ability.

Gobba F. [Subjective non-specific symptoms related with electromagnetic fields: description of 2 cases]. Epidemiol Prev. 26(4):171-175, 2002. [Article in Italian]

In Italy, as in other countries, an apparently increasing number of subjects is reporting a variety of subjective symptoms that the subjects themselves refer to the exposure to electric, magnetic or electromagnetic fields (EMF) from nearby electric appliances, cellular phones, antennas, etc. Terms like electricity hypersensitivity (EHS), EMF hypersensitivity, or other similar, are frequently adopted to describe such symptoms; nevertheless, up to now, these terms are not entered the medical terminology. No accepted diagnostic criteria or procedures for the diagnosis of EHS are currently available. Furthermore, apart from the subject's self-attribution of the symptoms to EMFs, no direct cause-effect relationship between EHS symptoms and electromagnetic fields has been proved; additionally, evidence of a possible pathogenetic mechanism is lacking. In this paper, two cases developing symptoms of EHS ascribed to overhead power line in the proximity of their house are discussed. Nervous system (asthenia, depression, paraesthesias etc.), cardiovascular system (cardiac palpitations) and the skin (tingling, itching, etc.), are mostly (but not exclusively) involved. Based on available scientific knowledge, the rationale for an approach to subjects claiming for EHS is discussed. The establishment of a National archive for the collection of cases is needed.

Gómez-Perretta C, Navarro EA, Segura J, Portolés M. Subjective symptoms related to GSM radiation from mobile phone base stations: a cross-sectional study. BMJ Open. 3(12):e003836, 2013.

OBJECTIVES: We performed a re-analysis of the data from Navarro et al (2003) in which health symptoms related to microwave exposure from mobile phone base stations (BSs) were explored, including data obtained in a retrospective inquiry about fear of exposure from BSs.

DESIGN: Cross-sectional study. **SETTING:** La Ñora (Murcia), Spain. **PARTICIPANTS:** Participants with known illness in 2003 were subsequently disregarded: 88 participants instead of 101 (in 2003) were analysed. Since weather circumstances can influence exposure, we restricted data to measurements made under similar weather conditions. **OUTCOMES AND**

METHODS: A statistical method indifferent to the assumption of normality was employed: namely, binary logistic regression for modelling a binary response (eg, suffering fatigue (1) or not (0)), and so exposure was introduced as a predictor variable. This analysis was carried out on a regular basis and bootstrapping (95% percentile method) was used to provide more accurate CIs. **RESULTS:** The symptoms most related to exposure were lack of appetite (OR=1.58, 95% CI 1.23 to 2.03); lack of concentration (OR=1.54, 95% CI 1.25 to 1.89); irritability (OR=1.51, 95% CI 1.23 to 1.85); and trouble sleeping (OR=1.49, 95% CI 1.20 to 1.84). Changes in -2 log likelihood showed similar results. Concerns about the BSs were strongly related with trouble sleeping (OR =3.12, 95% CI 1.10 to 8.86). The exposure variable remained statistically significant in the multivariate analysis. The bootstrapped values were similar to asymptotic CIs. **CONCLUSIONS:** This study confirms our preliminary results. We observed that the incidence of most of the symptoms was related to exposure levels-independently of the demographic variables and some possible risk factors. Concerns about adverse effects from exposure, despite being strongly related with sleep disturbances, do not influence the direct association between exposure and sleep.

Hagström M, Auranen J, Johansson O, Ekman R. Reducing electromagnetic irradiation and fields alleviates experienced health hazards of VDU work. Pathophysiology. 19(2):81-87, 2012

World Health Organisation (WHO) outlined in 2005 recommendations, how to treat people suffering from the functional impairment electrohypersensitivity in its document "Electromagnetic fields and public health". Unfortunately the reduction of electromagnetic fields was not considered as a treatment option. The aim of the current study was to shield the computer user from the emitted electromagnetic irradiation and fields and to correlate that to the subjective symptoms reported by electrohypersensitive volunteers. The irradiation of the shielding cabinets was recorded. They housed either separate computer screens or whole laptops. When the volunteers had used the shielding cabinet for 1-7 years, they were able work with their computers whole working day, Those who had used the shielding cabined for 2-3 months were partially symptom free. The person who had used the cabinet only for 1 week reported some alleviation of her nausea. In conclusion: it seems that reducing the electromagnetic irradiation of the computer can lessen the symptoms of electrohypersensitivity and permit working without problems. Further studies are needed to clarify how the symptoms of different organ systems recover and make computer users to work also professionally.

Hagström M, Auranen J, Ekman R. Electromagnetic hypersensitive Finns: Symptoms, perceived sources and treatments, a questionnaire study. Pathophysiology. 2013 Apr 1. pii: S0928-4680(13)00002-3.

The aim was to analyze the subjective experiences of Finns who describe themselves as suffering from electromagnetic hypersensitivity (EHS), their symptoms, self-perceived sources of the health complaints and the effectiveness of medical and complementary alternative therapies. A total of 395 questionnaires were mailed to self-diagnosed EHS persons. Of the participants 345 belonged to a Finnish self-help group and 50 came from outside of the group. The return rate of the study was 52.1% (206) and 80.9% of the respondents were women. Before the onset of EHS the most common health complaints were different types of allergies (35.1%, 68). During the acute phase of EHS the most common symptoms were nervous system related: "stress" (60.3%, 117), "sleeping disorders" (59.3%, 115) and "fatigue" (57.2%, 111). The sources that were most often reported to have triggered EHS were: "personal computers" (50.8%, 94) and "mobile phones" (47.0%, 87). The same devices were also claimed to cause the most symptoms during the acute phase. After the acute phase of EHS had passed, the

respondents still claimed to react to these same digital and wireless devices while their reactions to basic electrical appliances were reduced. According to 76% of 157 respondents the reduction or avoidance of electromagnetic fields (EMF) helped in their full or partial recovery. The best treatments for EHS were given as: "dietary change" (69.4%), "nutritional supplements" (67.8%) and "increased physical exercise" (61.6%). The official treatment recommendations of psychotherapy (2.6%) and medication (-4.2%) were not significantly helpful. According to the present results the official treatment protocols should take better account the EHS person's own experiences. The avoidance of electromagnetic radiation and fields effectively removed or lessened the symptoms in EHS persons.

Hardell L, Carlberg M, Söderqvist F, Hardell K, Björnfoth H, van Bavel B, Lindström G. Increased concentrations of certain persistent organic pollutants in subjects with self-reported electromagnetic hypersensitivity--a pilot study. Electromagn Biol Med. 27(2):197-203, 2008.

Electromagnetic hypersensitivity (EHS) is used for a variety of subjective symptoms related to exposure to electromagnetic fields (EMF). The aim of this pilot study was to analyze the concentrations of certain persistent organic pollutants (POPs) in subjects with self-reported EHS. In total, 13 EHS subjects and 21 controls were included, all female. The concentration of several POPs was higher in EHS subjects than in controls. Lower concentrations were found for hexachlorobenzene and two types of chlordanes. The only significantly increased odds ratios (ORs) were found for polybrominated diphenyl ether (PBDE) #47 yielding OR=11.7, 95% confidence interval (CI)=1.45-94.7 and the chlordane metabolite MC6 with OR=11.2, 95% CI=1.18-106. The results were based on low numbers and must be interpreted with caution. This hypothesis generating study indicates the necessity of a larger investigation on this issue.

Havas M Radiation from wireless technology affects the blood, the heart, and the autonomic nervous system. Rev Environ Health. 28(2-3):75-84, 2013.

Exposure to electrosmog generated by electric, electronic, and wireless technology is accelerating to the point that a portion of the population is experiencing adverse reactions when they are exposed. The symptoms of electrohypersensitivity (EHS), best described as rapid aging syndrome, experienced by adults and children resemble symptoms experienced by radar operators in the 1940s to the 1960s and are well described in the literature. An increasingly common response includes clumping (rouleau formation) of the red blood cells, heart palpitations, pain or pressure in the chest accompanied by anxiety, and an upregulation of the sympathetic nervous system coincident with a downregulation of the parasympathetic nervous system typical of the "fight-or-flight" response. Provocation studies presented in this article demonstrate that the response to electrosmog is physiologic and not psychosomatic. Those who experience prolonged and severe EHS may develop psychologic problems as a consequence of their inability to work, their limited ability to travel in our highly technologic environment, and the social stigma that their symptoms are imagined rather than real.

Havas M, Marrongelle J. Replication of heart rate variability provocation study with 2.4-GHz cordless phone confirms original findings. Electromagn Biol Med. 32(2):253-266, 2013.

This is a replication of a study that we previously conducted in Colorado with 25 subjects designed to test the effect of electromagnetic radiation generated by the base station of a cordless phone on heart rate variability (HRV). In this study, we analyzed the response of 69

subjects between the ages of 26 and 80 in both Canada and the USA. Subjects were exposed to radiation for 3-min intervals generated by a 2.4-GHz cordless phone base station (3-8 $\mu\text{W}/\text{cm}^2$). A few participants had a severe reaction to the radiation with an increase in heart rate and altered HRV indicative of an alarm response to stress. Based on the HRV analyses of the 69 subjects, 7% were classified as being "moderately to very" sensitive, 29% were "little to moderately" sensitive, 30% were "not to little" sensitive and 6% were "unknown". These results are not psychosomatic and are not due to electromagnetic interference. Twenty-five percent of the subjects' self-proclaimed sensitivity corresponded to that based on the HRV analysis, while 32% overestimated their sensitivity and 42% did not know whether or not they were electrically sensitive. Of the 39 participants who claimed to experience some electrical hypersensitivity, 36% claimed they also reacted to a cordless phone and experienced heart symptoms and, of these, 64% were classified as having some degree of electrohypersensitivity (EHS) based on their HRV response. Novel findings include documentation of a delayed response to radiation. Orthostatic HRV testing combined with provocation testing may provide a diagnostic tool for some sufferers of EHS when they are exposed to electromagnetic emitting devices. The protocol used underestimates reaction to electromagnetic radiation for those who have a delayed autonomic nervous system reaction and it may under diagnose those who have adrenal exhaustion as their ability to mount a response to a stressor is diminished.

Hedendahl L, Carlberg M, Hardell L. Electromagnetic hypersensitivity - an increasing challenge to the medical profession. *Rev Environ Health*. 2015;30(4):209-15.

BACKGROUND: In 1970, a report from the former Soviet Union described the "microwave syndrome" among military personnel, working with radio and radar equipment, who showed symptoms that included fatigue, dizziness, headaches, problems with concentration and memory, and sleep disturbances. Similar symptoms were found in the 1980s among Swedes working in front of cathode ray tube monitors, with symptoms such as flushing, burning, and tingling of the skin, especially on the face, but also headaches, dizziness, tiredness, and photosensitivity. The same symptoms are reported in Finns, with electromagnetic hypersensitivity (EHS) being attributed to exposure to electromagnetic fields (EMF). Of special concern is involuntary exposure to radiofrequency (RF)-EMF from different sources. Most people are unaware of this type of exposure, which has no smell, color, or visibility. There is an increasing concern that wireless use of laptops and iPads in Swedish schools, where some have even abandoned textbooks, will exacerbate the exposure to EMF.

METHODS: We have surveyed the literature on different aspects of EHS and potential adverse health effects of RF-EMF. This is exemplified by case reports from two students and one teacher who developed symptoms of EHS in schools using Wi-Fi.

RESULTS: In population-based surveys, the prevalence of EHS has ranged from 1.5% in Sweden to 13.3% in Taiwan. Provocation studies on EMF have yielded different results, ranging from where people with EHS cannot discriminate between an active RF signal and placebo, to objectively observed changes following exposure in reactions of the pupil, changes in heart rhythm, damage to erythrocytes, and disturbed glucose metabolism in the brain. The two students and the teacher from the case reports showed similar symptoms, while in school environments, as those mentioned above.

DISCUSSION: Austria is the only country with a written suggestion to guidelines on the diagnosis and treatment of EMF-related health problems. Apart from this, EHS is not recognized as a specific diagnosis in the rest of the world, and no established treatment exists.

CONCLUSION: It seems necessary to give an International Classification of Diseases to EHS to get it accepted as EMF-related health problems. The increasing exposure to RF-EMF in schools is of great concern and needs better attention. Longer-term health effects are unknown. Parents, teachers, and school boards have the responsibility to protect children from unnecessary exposure.

Heuser G, Heuser SA. Functional brain MRI in patients complaining of electrohypersensitivity after long term exposure to electromagnetic fields. Rev Environ Health. 32(3):291-299, 2017.

INTRODUCTION: Ten adult patients with electromagnetic hypersensitivity underwent functional magnetic resonance imaging (fMRI) brain scans. All scans were abnormal with abnormalities which were consistent and similar. It is proposed that fMRI brain scans be used as a diagnostic aid for determining whether or not a patient has electromagnetic hypersensitivity. Over the years we have seen an increasing number of patients who had developed multi system complaints after long term repeated exposure to electromagnetic fields (EMFs). These complaints included headaches, intermittent cognitive and memory problems, intermittent disorientation, and also sensitivity to EMF exposure. Regular laboratory tests were within normal limits in these patients. The patients refused to be exposed to radioactivity. This of course ruled out positron emission tomography (PET) and single-photon emission computed tomography (SPECT) brain scanning. This is why we ordered fMRI brain scans on these patients. We hoped that we could document objective abnormalities in these patients who had often been labeled as psychiatric cases.

MATERIALS AND METHODS: Ten patients first underwent a regular magnetic resonance imaging (MRI) brain scan, using a 3 Tesla Siemens Verio MRI open system. A functional MRI study was then performed in the resting state using the following sequences: A three-dimensional, T1-weighted, gradient-echo (MPRAGE) Resting state network. The echo-planar imaging (EPI) sequences for this resting state blood oxygenation level dependent (BOLD) scan were then post processed on a 3D workstation and the independent component analysis was performed separating out the various networks. Arterial spin labeling. Tractography and fractional anisotropy. **RESULTS:** All ten patients had abnormal functional MRI brain scans. The abnormality was often described as hyper connectivity of the anterior component of the default mode in the medial orbitofrontal area. Other abnormalities were usually found. Regular MRI studies of the brain were mostly unremarkable in these patients. **CONCLUSION:** We propose that functional MRI studies should become a diagnostic aid when evaluating a patient who claims electrohypersensitivity (EHS) and has otherwise normal studies. Interestingly, the differential diagnosis for the abnormalities seen on the fMRI includes head injury. It turns out that many of our patients indeed had a history of head injury which was then followed sometime later by the development of EHS. Many of our patients also had a history of exposure to potentially neurotoxic chemicals, especially mold. Head injury and neurotoxic chemical exposure may make a patient more vulnerable to develop EHS.

Hietanen M, Hämäläinen AM, Husman T. Hypersensitivity symptoms associated with exposure to cellular telephones: no causal link. Bioelectromagnetics. 23(4):264-270, 2002.

The hypothesis that there exist hypersensitive persons who perceive subjective symptoms from radiofrequency (RF) fields emitted by hand held mobile phones (cellular phones) was tested using double blind provocation experiments. We also tested whether sensitive subjects are able to determine whether the phone is on or off by sensing RF fields. The study group consisted of 20 volunteers (13 women and 7 men) who reported themselves as being sensitive to cellular phones. The RF exposure sources were one analogue NMT phone (900 MHz) and two digital

GSM phones (900 and 1800 MHz). The duration of a test session was 30 min, and three or four sessions were performed in random order for each subject during 1 day. The subjects were asked to report symptoms or sensations as soon as they perceived any abnormal feelings. In addition, the subjects' blood pressure, heart rate, and breathing frequency were monitored every 5 min. The results of the study indicated that various symptoms were reported, and most of them appeared in the head region. However, the number of reported symptoms was higher during sham exposure than during real exposure conditions. In addition, none of the test persons could distinguish real RF exposure from sham exposure. Hence, we conclude that adverse subjective symptoms or sensations, though unquestionably perceived by the test subjects, were not produced by cellular phones.

Hillert L, Kolmodin Hedman B, Dörling BF, Arnetz BB. Cognitive behavioural therapy for patients with electric sensitivity - a multidisciplinary approach in a controlled study. *Psychother Psychosom.* 67(6):302-310, 1998.

BACKGROUND: Electric sensitivity is a syndrome that still lacks diagnostic criteria and proven aetiology. The suffering of afflicted persons motivates development and evaluation of effective handling and treatments. The aim of the study was to evaluate the effect of cognitive behavioural therapy in patients with electric sensitivity. **METHODS:** Cognitive behavioural treatment, as part of a multidisciplinary treatment package for patients with electric sensitivity, was evaluated in a controlled trial. Ten patients who received treatment were compared to 12 controls. Outcome measures included different dimensions such as symptoms, beliefs, behaviour, and biochemical measurements of stress-related variables. All outcome measures were collected prior to the study, post-treatment, and after an additional 6-month follow-up. **RESULTS:** The therapy group rated their electric sensitivity as significantly lower than did the control group at the 6-month follow-up, and reduction of self-rated discomforts from triggering factors was significant in the therapy group. There were no systematic changes in the biochemical variables. The symptom indices were significantly reduced over time, and ability to work continued to be good in both groups. **CONCLUSION:** The prognosis for this syndrome is good with early intervention and cognitive therapy may further reduce the perceived hypersensitivity. This may have important implications on handling of patients with electric sensitivity.

Hillert L, Flato S, Georgellis A, Arnetz BB, Kolmodin-Hedman B. Environmental illness: fatigue and cholinesterase activity in patients reporting hypersensitivity to electricity. *Environ Res.* 85(3):200-206, 2001.

The lack of a pathophysiological marker hinders studies on environmental illnesses of unknown origin. Hence, research focused on the identification of such a marker is a priority. This study investigated the nature and a possible etiology of fatigue in hypersensitivity to electricity (the most commonly reported environmental illness in Sweden). The aim was to test the hypothesis that perceived fatigue was due to alterations in cholinesterase activity. The study group consisted of 14 people who reported a hypersensitivity to electricity, including disabling fatigue. We assessed cholinesterase activity three times: twice based on current symptoms reported by the subjects (severe fatigue attributed to electromagnetic fields and absence of this symptom) and once at a randomly selected time. No significant reduction in acetylcholinesterase was identified in any subject. Examined on a group level, no significant reduction in activity was identified at the time of severe fatigue, and no correlation between reported degree of fatigue and cholinesterase activity was observed. Fatigue attributed to electromagnetic fields was nonphysical and showed a significant correlation to difficulties in concentrating. The results do

not support the hypothesis that a change in cholinesterase activity mediates fatigue in people reporting hypersensitivity to electricity.

Hillert L, Berglind N, Arnetz BB, Bellander T. Prevalence of self-reported hypersensitivity to electric or magnetic fields in a population-based questionnaire survey. Scand J Work Environ Health. 28(1):33-41, 2002.

OBJECTIVES: The prevalence of medically unexplained symptoms attributed to exposure to electromagnetic fields is still largely unknown. Previous studies have investigated reported hypersensitivity to electricity in selected groups recruited from workplaces or outpatient clinics. The aim of this study was to estimate the prevalence of self-reported hypersensitivity to electric or magnetic fields in the general population and to describe characteristics of the group reporting such hypersensitivity with regard to demographics, other complaints, hypersensitivities, and traditional allergies. **METHODS:** A cross-sectional questionnaire survey was conducted in 1997 among 15,000 men and women between 19 and 80 years of age in Stockholm County. The response rate was 73%. **RESULTS:** One and a half percent of the respondents reported hypersensitivity to electric or magnetic fields. Prevalence was highest among women and in the 60- to 69-year age group. The hypersensitive group reported all symptoms, allergies, and other types of hypersensitivities included in the survey (as well as being disturbed by various factors in the home) to a significantly greater extent than the rest of the respondents. No specific symptom profile set off the hypersensitive group from the rest of the respondents. **CONCLUSIONS:** The results should be interpreted with caution. But they suggest that there is widespread concern among the general population about risks to health posed by electric and magnetic fields. More research is warranted to explore ill health among people reporting hypersensitivity to electric or magnetic fields.

Huiberts A, Hjørnevik M, Mykletun A, Skogen JC. Electromagnetic hypersensitivity (EHS) in the media - a qualitative content analysis of Norwegian newspapers. JRSM Short Rep. 2013 Oct 4;4(11):2042533313487332

OBJECTIVES: Electromagnetic hypersensitivity (EHS) is a condition characterized by experiencing symptoms after perceived exposure to weak electromagnetic fields (EMFs). There is substantial debate concerning the aetiology of EHS, but experimental data indicate no association between EHS and actual presence of EMFs. Newspapers play a key role in shaping peoples' understanding of health-related issues. The aim of this study was to describe the content of newspaper articles concerning aetiology and treatment of EHS. **DESIGN:** Qualitative content analysis of newspaper articles. **SETTING:** Norwegian newspaper articles were identified using a comprehensive electronic media archive. **PARTICIPANTS:** Norwegian newspaper articles published between 1 February 2006 and 11 August 2010. **MAIN OUTCOME MEASURES:** Statements coded according to source of information, whether it was pro or con scientific evidence on EHS aetiology, and type of intervention presented as treatment option for EHS. **RESULTS:** Of the statements concerning EHS aetiology (n = 196), 35% (n = 69) were categorized as pro evidence, 65% (n = 127) as con evidence. Of the statements about EHS interventions assessed, 78% (n = 99) were categorized as 'radiance reduction', 4% (n = 5) as 'complementary medicine', and 18% (n = 23) as 'other'. Cognitive behavioural therapy (CBT) and psychotropic drugs were never presented as possible treatment options for EHS. **CONCLUSIONS:** The newspaper media discourse of EHS aetiology and recommended treatment interventions is much in conflict with the current evidence in the field. The majority of statements concerning aetiology convey that EHS is related to the presence of weak EMFs, and radiance reduction as the most frequently conveyed measure to reduce EHS-related symptoms.

Huss A, Röögli M. Consultations in primary care for symptoms attributed to electromagnetic fields—a survey among general practitioners. BMC Public Health. 6:267, 2006.

BACKGROUND: Five percent of the Swiss population attribute symptoms to electromagnetic fields (EMF). General practitioners (GPs) might play a key role in recognising an emerging health risk, since they are the first to observe and follow up persons who attribute symptoms to EMF. It is unclear to what extent EMFs have become an issue in general practice and which experiences GPs report from the consultations. **METHODS:** We conducted telephone interviews in a random sample of GPs in Switzerland in order to assess the frequency of consultations in primary care due to EMF and the GPs' experience with these patients. **RESULTS:** 342 general practitioners were interviewed, corresponding to a response rate of 28.2%. 69% of the GPs reported at least one consultation due to EMF, but GPs with a certificate in complementary medicine were much more likely to report EMF consultations. The median of EMF consultation numbers within one year was three. An overview of the most recent EMF-related consultation per GP yielded sleep disorders, headaches and fatigue as the most often reported symptoms and mobile phone base stations, power lines and the own use of mobile phones as the main EMF sources suspected to be associated to symptoms. GPs judged the association between EMF and the symptoms to be plausible in 54% of the cases. There was no combination of symptoms and EMF sources that was remarkably and consistently judged to be a plausible cause of the symptoms. **CONCLUSION:** In our survey, GPs often judged the association between the health problems and the suspected exposure to be plausible. This plausibility assessment seems to be based on grounds of preventive positions in a situation of scientific uncertainty. More research effort is needed to obtain more insight on a potential association between long term EMF exposure and unspecific symptoms.

Johansson A, Forsgren S, Stenberg B, Wilén J, Kalezic N, Sandström M. No effect of mobile phone-like RF exposure on patients with atopic dermatitis. Bioelectromagnetics. 29(5):353-362, 2008.

This study investigates the effect of exposure to a mobile phone-like radiofrequency (RF) electromagnetic field on people with atopic dermatitis (AD). Fifteen subjects with AD were recruited and matched with 15 controls without AD. The subjects were exposed for 30 min to an RF field at 1 W/kg via an indoor base station antenna attached to a 900 MHz GSM mobile phone. Blood samples for ELISA analysis of the concentration of substance P (SP), tumor necrosis factor receptor 1 (TNF R1), and brain derived neurotrophic factor (BDNF) in serum were drawn before and after the provocation (exposure/sham). Baseline heart rate and heart rate variability, local blood flow, and electrodermal activity were also recorded. No significant differences between the subject groups were found for baseline neurophysiological data. The cases displayed a serum concentration of TNF R1 significantly higher than the control subjects and a significantly lower serum concentration of BDNF in the baseline condition. For SP there was no difference between groups. However, no effects related to RF exposure condition were encountered for any of the measured substances. As to symptoms, a possible correlation with exposure could not be evaluated, due to too few symptom reports. The result of the study does not support the hypothesis of an effect of mobile phone-like RF exposure on serum levels of SP, TNF R1, and BDNF in persons with AD.

Johansson A, Nordin S, Heiden M, Sandström M. Symptoms, personality traits, and stress in people with mobile phone-related symptoms and electromagnetic hypersensitivity. J Psychosom Res. 68(1):37-45, 2010.

OBJECTIVE: Some people report symptoms that they associate with electromagnetic field (EMF) exposure. These symptoms may be related to specific EMF sources or to electrical equipment in general (perceived electromagnetic hypersensitivity, EHS). Research and clinical observations suggest a difference between mobile phone (MP)-related symptoms and EHS with respect to symptom prevalence, psychological factors, and health prognosis. This study assessed prevalence of EMF-related and EMF-nonrelated symptoms, anxiety, depression, somatization, exhaustion, and stress in people with MP-related symptoms or EHS versus a population-based sample and a control sample without EMF-related symptoms. **METHODS:** Forty-five participants with MP-related symptoms and 71 with EHS were compared with a population-based sample (n=106) and a control group (n=63) using self-report questionnaires. **RESULTS:** The EHS group reported more symptoms than the MP group, both EMF-related and EMF-nonrelated. The MP group reported a high prevalence of somatosensory symptoms, whereas the EHS group reported more neurasthenic symptoms. As to self-reported personality traits and stress, the case groups differed only on somatization and listlessness in a direct comparison. In comparison with the reference groups, the MP group showed increased levels of exhaustion and depression but not of anxiety, somatization, and stress; the EHS group showed increased levels for all of the conditions except for stress. **CONCLUSION:** The findings support the idea of a difference between people with symptoms related to specific EMF sources and people with general EHS with respect to symptoms and anxiety, depression, somatization, exhaustion, and stress. The differences are likely to be important in the management of patients.

Johansson O, Hilliges M, Han SW. A screening of skin changes, with special emphasis on neurochemical marker antibody evaluation, in patients claiming to suffer from "screen dermatitis" as compared to normal healthy controls. Exp Dermatol. 5(5):279-285, 1996.

In the present study, facial skin from so-called "screen dermatitis" patients were compared with corresponding material from normal healthy volunteers. The aim of the study was to evaluate possible markers to be used for future double-blind or blind provocation investigations. Differences were found for the biological markers calcitonin gene-related peptide (CGRP), somatostatin (SOM), vasoactive intestinal polypeptide (VIP), peptide histidine isoleucine amide (PHI), neuropeptide tyrosine (NPY), protein S-100 (S-100), neuron-specific enolase (NSE), protein gene product (PGP) 9.5 and phenylethanolamine N-methyltransferase (PNMT). The overall impression in the blind-coded material was such that it turned out easy to blindly separate the two groups from each other. However, no single marker was 100% able to pinpoint the difference, although some were quite powerful in doing so (CGRP, SOM, S-100). However, it has to be pointed out that we cannot, based upon the present results, draw any definitive conclusions about the cause of the changes observed. Whether this is due to electric or magnetic fields, a surrounding airborne chemical, humidity, heating, stress factors, or something else, still remains an open question. Blind or double-blind provocations in a controlled environment are necessary to elucidate possible underlying causes for the changes reported in this investigation.

Johansson O. Electrohypersensitivity: state-of-the-art of a functional impairment. Electromagn Biol Med. 25(4):245-258, 2006.

Recently, a new category of persons, claiming to suffer from exposure to electromagnetic fields, has been described in the literature. In Sweden, electrohypersensitivity (EHS) is an officially fully recognized functional impairment (i.e., it is not regarded as a disease). Survey studies

show that somewhere between 230,000-290,000 Swedish men and women report a variety of symptoms when being in contact with electromagnetic field (EMF) sources. The aim of our studies has been to investigate possible alterations, in the cellular and neuronal systems of these person' skin. As controls, age- and sex-matched persons, without any subjective or clinical symptoms or dermatological history, served. Immunohistochemistry using antisera to the previously characterized marker substances of interest has been utilized. In summary, it is evident from our preliminary data that various alterations are present in the electrohypersensitive person' skin. In view of recent epidemiological studies, pointing to a correlation between long-term exposure from power-frequent magnetic fields or microwaves and cancer, our data ought to be taken seriously and further analyzed.

Johansson O. Electrohypersensitivity: a functional impairment due to an inaccessible environment. Rev Environ Health. 2015 Dec 1;30(4):311-21. doi: 10.1515/reveh-2015-0018.

In Sweden, electrohypersensitivity is recognized as a functional impairment which implies only the environment as the culprit. The Swedish view provides persons with this impairment a maximal legal protection, it gives them the right to get accessibility measures for free, as well as governmental subsidies and municipality economic support, and to provide them with special Ombudsmen (at the municipality, the EU, and the UN level, respectively), the right and economic means to form disability organizations and allow these to be part of national and international counterparts, all with the simple and single aim to allow persons with the functional impairment electrohypersensitivity to live an equal life in a society based on equality. They are not seen as patients, they do not have an overriding medical diagnosis, but the 'patient' is only the inferior and potentially toxic environment. This does not mean that a subjective symptom of a functionally impaired can not be treated by a physician, as well as get sick-leave from their workplace as well as economic compensation, and already in the year 2000 such symptoms were identified in the Internal Code of Diagnoses, version 10 (ICD-10; R68.8/now W90), and have been since. But the underlying cause still remains only the environment.
<http://1.usa.gov/1YFwzkd>

Kim DW, Lee JH, Ji HC, Kim SC, Nam KC, Cha EJ. Physiological effects of RF exposure on hypersensitive people by a cell phone. Conf Proc IEEE Eng Med Biol Soc. 2008:2322-2325, 2008.

Persons with electromagnetic hypersensitivity (EHS) complain of subjective symptoms such as headaches, insomnia, memory loss etc. resulting from radio frequency (RF) radiation by cellular phones. There have been various EHS provocation studies on heart rate, blood pressure, and subjective symptoms using GSM phones. However, there are few provocation studies on case-control study investigating simultaneously physiological parameters from CDMA phones. In this study, two volunteer groups of 18 self-declared EHS and 19 controls were exposed to both sham and real RF exposures by a CDMA cellular phone for half an hour each. We investigated the physiological parameters such as heart rates, respiration rates, and hear rate variability (HRV). In conclusion, the RF exposure by a CDMA cellular phone did not have any effects on the physiological parameters for both groups.

Kim DW, Choi JL, Nam KC, Yang DI, Kwon MK. Origins of electromagnetic hypersensitivity to 60 Hz magnetic fields: A provocation study. Bioelectromagnetics. 2011 Oct 19. doi: 10.1002/bem.20711. [Epub ahead of print]

With increasing electrical device usage, social concerns about the possible effects of 60 Hz electromagnetic fields on human health have increased. The number of people with self-

attributed electromagnetic hypersensitivity (EHS) who complain of various subjective symptoms such as headache and insomnia has also increased. However, it is unclear whether EHS results from physiological or other origins. In this double-blinded study, we simultaneously investigated physiological changes (heart rate, respiration rate, and heart rate variability), subjective symptoms, and perception of the magnetic field to assess origins of the subjective symptoms. Two volunteer groups of 15 self-reported EHS and 16 non-EHS individuals were tested with exposure to sham and real (60 Hz, 12.5 μ T) magnetic fields for 30 min. Magnetic field exposure did not have any effects on physiological parameters or eight subjective symptoms in either group. There was also no evidence that the EHS group perceived the magnetic field better than the non-EHS group. In conclusion, the subjective symptoms did not result from the 60 Hz, 12.5 μ T magnetic field exposures but from other non-physiological factors.

Küçer N, Pamukçu T. Self-reported symptoms associated with exposure to electromagnetic fields: a questionnaire study. *Electromagn Biol Med.* 33(1):15-17, 2014.

In the last years, it has been discussed frequently whether there are any harmful effects of electromagnetic fields on human health. Electromagnetic fields are generated by several natural and man-made sources. Part of the electromagnetic spectrum called Radiofrequency is used in communication systems such as mobile (cellular) phone and computer. The aim of our study was to explore different self-reported symptoms that may be associated with exposure to electromagnetic fields. This survey study was conducted, using a questionnaire, on 350 people aged +9 years in Turkey. The chi-square test was used for data analysis. Self-reported symptoms were headache, vertigo/dizziness, fatigue, forgetfulness, sleep disturbance-insomnia, tension-anxiety, joint and bone pain, lacrimation of the eyes, hearing loss and tinnitus. As a result of the survey, the study has shown that users of mobile phone and computer more often complained of headache, joint and bone pain, hearing loss, vertigo/dizziness, tension-anxiety symptoms according to time of daily usage ($p < 0.05$). In users of mobile phone and computer, women significantly ($p < 0.05$) complained more often of headache, vertigo/dizziness, fatigue, forgetfulness and tension-anxiety than men.

Kwon MK, Nam KC, Lee da S, Jang KH, Kim DW. Effects of RF fields emitted from smart phones on cardio-respiratory parameters: a preliminary provocation study. *Conf Proc IEEE Eng Med Biol Soc.* 2011:1961-1964, 2011.

This paper describes an experimental setup for evaluating the physiological effects of radiofrequency (RF) emitted from a Wideband Code Division Multiple Access (WCDMA) module with a 24 dBm at 1950 MHz for specific absorption rate (SAR(1g)) of 1.57 W/kg. This provocation study was executed in a double-blind study of two volunteer groups of 10 self-reported electromagnetic hypersensitivity (EHS) and 10 non-EHS subjects under both sham and real exposures in a randomly assigned and counter-balanced order. In the preliminary results, WCDMA RF exposure of 30 min did not have any effects on physiological changes in either group.

Kwon MK, Choi JY, Kim SK, Yoo TK, Kim DW. Effects of radiation emitted by WCDMA mobile phones on electromagnetic hypersensitive subjects. *Environ Health.* 11:69. 2012. doi: 10.1186/1476-069X-11-69.

BACKGROUND: With the use of the third generation (3 G) mobile phones on the rise, social concerns have arisen concerning the possible health effects of radio frequency-electromagnetic fields (RF-EMFs) emitted by wideband code division multiple access (WCDMA) mobile phones

in humans. The number of people with self-reported electromagnetic hypersensitivity (EHS), who complain of various subjective symptoms such as headache, dizziness and fatigue, has also increased. However, the origins of EHS remain unclear. METHODS: In this double-blind study, two volunteer groups of 17 EHS and 20 non-EHS subjects were simultaneously investigated for physiological changes (heart rate, heart rate variability, and respiration rate), eight subjective symptoms, and perception of RF-EMFs during real and sham exposure sessions. Experiments were conducted using a dummy phone containing a WCDMA module (average power, 24 dBm at 1950 MHz; specific absorption rate, 1.57 W/kg) within a headset placed on the head for 32 min. RESULTS: WCDMA RF-EMFs generated no physiological changes or subjective symptoms in either group. There was no evidence that EHS subjects perceived RF-EMFs better than non-EHS subjects. CONCLUSIONS: Considering the analyzed physiological data, the subjective symptoms surveyed, and the percentages of those who believed they were being exposed, 32 min of RF radiation emitted by WCDMA mobile phones demonstrated no effects in either EHS or non-EHS subjects.

Kwon MK, Kim SK, Koo JM, Choi JY, Kim DW. EHS subjects do not perceive RF EMF emitted from smart phones better than non-EHS subjects. Conf Proc IEEE Eng Med Biol Soc. 2012:2190-2193, 2012.

As the use of smart phones increases, social concerns have arisen concerning the possible effects of radio frequency-electromagnetic fields (RF-EMFs) emitted from wideband code division multiple access (WCDMA) mobile phones on human health. The number of people with self-reported electromagnetic hypersensitivity (EHS) who complain of various subjective symptoms, such as headache, insomnia, etc., has also recently increased. However, it is unclear whether EHS subjects can detect RF-EMFs exposure or not. In this double-blind study, two volunteer groups of 17 EHS and 20 non-EHS subjects were investigated in regards to their perception of RF-EMFs with real and sham exposure sessions. Experiments were conducted using a WCDMA module inside a dummy phone with an average power of 24 dBm at 1950 MHz and a specific absorption rate of 1.57 W/kg using a dummy headphone for 32 min. In conclusion, there was no indication that EHS subjects perceive RF-EMFs better than non-EHS subjects.

Landgrebe M, Frick U, Hauser S, Langguth B, Rosner R, Hajak G, Eichhammer P. Cognitive and neurobiological alterations in electromagnetic hypersensitive patients: results of a case-control study. Psychol Med. 38(12):1781-1791, 2008.

BACKGROUND: Hypersensitivity to electromagnetic fields (EMF) is frequently claimed to be linked to a variety of non-specific somatic and neuropsychological complaints. Whereas provocation studies often failed to demonstrate a causal relationship between EMF exposure and symptom formation, recent studies point to a complex interplay of neurophysiological and cognitive alterations contributing to symptom manifestation in electromagnetic hypersensitive patients (EHS). However, these studies have examined only small sample sizes or have focused on selected aspects. Therefore this study examined in the largest sample of EHS EMF-specific cognitive correlates, discrimination ability and neurobiological parameters in order to get further insight into the pathophysiology of electromagnetic hypersensitivity. METHOD: In a case-control design 89 EHS and 107 age- and gender-matched controls were included in the study. Health status and EMF-specific cognitions were evaluated using standardized questionnaires. Perception thresholds following single transcranial magnetic stimulation (TMS) pulses to the dorsolateral prefrontal cortex were determined using a standardized blinded measurement protocol. Cortical excitability parameters were measured by TMS. RESULTS: Discrimination ability was significantly reduced in EHS (only 40% of the EHS but 60% of the

controls felt no sensation under sham stimulation during the complete series), whereas the perception thresholds for real magnetic pulses were comparable in both groups (median 21% versus 24% of maximum pulse intensity). Intra-cortical facilitation was decreased in younger and increased in older EHS. In addition, typical EMF-related cognitions (aspects of rumination, symptom intolerance, vulnerability and stabilizing self-esteem) specifically differentiated EHS from their controls. **CONCLUSIONS:** These results demonstrate significant cognitive and neurobiological alterations pointing to a higher genuine individual vulnerability of electromagnetic hypersensitive patients.

Landgrebe M, Hauser S, Langguth B, Frick U, Hajak G, Eichhammer P. Altered cortical excitability in subjectively electrosensitive patients: results of a pilot study. J Psychosom Res. 62(3):283-288, 2007.

OBJECTIVE: Hypersensitivity to electromagnetic fields is frequently claimed to be linked to a variety of unspecific somatic and/or neuropsychological complaints. Whereas provocation studies often failed to demonstrate a causal relationship between electromagnetic field exposure and symptom formation, neurophysiological examinations highlight baseline deviations in people claiming to be electrosensitive. **METHODS:** To elucidate a potential role of dysfunctional cortical regulations in mediating hypersensitivity to electromagnetic fields, cortical excitability parameters were measured by transcranial magnetic stimulation in subjectively electrosensitive patients (n=23) and two control groups (n=49) differing in their level of unspecific health complaints. **RESULTS:** Electrosensitive patients showed reduced intracortical facilitation as compared to both control groups, while motor thresholds and intracortical inhibition were unaffected. **CONCLUSIONS:** This pilot study gives additional evidence that altered central nervous system function may account for symptom manifestation in subjectively electrosensitive patients as has been postulated for several chronic multisymptom illnesses sharing a similar clustering of symptoms.

Landgrebe M, Frick U, Hauser S, Hajak G, Langguth B. Association of tinnitus and electromagnetic hypersensitivity: hints for a shared pathophysiology? PLoS One. 4(3):e5026, 2009.

BACKGROUND: Tinnitus is a frequent condition with high morbidity and impairment in quality of life. The pathophysiology is still incompletely understood. Electromagnetic fields are discussed to be involved in the multi-factorial pathogenesis of tinnitus, but data proofing this relationship are very limited. Potential health hazards of electromagnetic fields (EMF) have been under discussion for long. Especially, individuals claiming themselves to be electromagnetic hypersensitive suffer from a variety of unspecific symptoms, which they attribute to EMF-exposure. The aim of the study was to elucidate the relationship between EMF-exposure, electromagnetic hypersensitivity and tinnitus using a case-control design. **METHODOLOGY:** Tinnitus occurrence and tinnitus severity were assessed by questionnaires in 89 electromagnetic hypersensitive patients and 107 controls matched for age-, gender, living surroundings and workplace. Using a logistic regression approach, potential risk factors for the development of tinnitus were evaluated. **FINDINGS:** Tinnitus was significantly more frequent in the electromagnetic hypersensitive group (50.72% vs. 17.5%) whereas tinnitus duration and severity did not differ between groups. Electromagnetic hypersensitivity and tinnitus were independent risk factors for sleep disturbances. However, measures of individual EMF-exposure like e.g. cell phone use did not show any association with tinnitus. **CONCLUSIONS:** Our data indicate that tinnitus is associated with subjective electromagnetic hypersensitivity. An individual vulnerability probably due to an over activated cortical distress network seems to be responsible

for, both, electromagnetic hypersensitivity and tinnitus. Hence, therapeutic efforts should focus on treatment strategies (e.g. cognitive behavioral therapy) aiming at normalizing this dysfunctional distress network.

Leitgeb N, Schröttner J. Electrosensitivity and electromagnetic hypersensitivity. Bioelectromagnetics. 24(6):387-394, 2003.

Electromagnetic sensibility, the ability to perceive electric and electromagnetic exposure, and electromagnetic hypersensitivity (EHS), developing health symptoms due to exposure to environmental electromagnetic fields, need to be distinguished. Increased electrosensitivity is a necessary, however, not a sufficient condition for electromagnetic hypersensitivity. At an extended sample of the general population of 708 adults, including 349 men and 359 women aged between 17 and 60 years, electrosensitivity was investigated and characterized by perception threshold and its standard deviation. By analyzing the probability distributions of the perception threshold of electric 50 Hz currents, evidence could be found for the existence of a subgroup of people with significantly increased electrosensitivity (hypersensitivity) who as a group could be differentiated from the general population. The presented data show that the variation of the electrosensitivity among the general population is significantly larger than has yet been estimated by nonionizing radiation protection bodies, but much smaller than claimed by hypersensitivity self-aid groups. These quantitative results should contribute to a less emotional discussion of this problem. The investigation method presented, is capable of exclusion diagnostics for persons suffering from the hypersensitivity syndrome.

Levallois P. Hypersensitivity of human subjects to environmental electric and magnetic field exposure: a review of the literature. Environ Health Perspect. 110 Suppl 4:613-618, 2002.

Hypersensitivity to exposure to electric and magnetic fields (EMFs) has been reported for nearly 20 years; however, the literature on the subject is still very limited. Nearly all the literature published concerns a dermatological syndrome that consists of mainly subjective symptoms (itching, burning, dryness) and a few objective symptoms (redness, dryness) appearing after individuals begin working with video display units and decreasing during absence from work. Case-control studies as well as some good but limited double-blind trials have not found any clear relationship between this syndrome and exposure to EMFs. A "general syndrome" with more general symptoms has been rarely described but seems to have a worse prognosis. The symptoms often associated with skin disorders are mainly of neurasthenic type and can cover a lot of nonspecific symptoms present in other atypical syndromes such as multiple chemical sensitivity or chronic fatigue. Most of these symptoms are allegedly triggered by exposure to different sources of EMFs, but there have been no valid etiological studies published on this more general syndrome. It appears that the so-called hypersensitivity to environmental electric and magnetic fields is an unclear health problem whose nature has yet to be determined.

Levallois P, Neutra R, Lee G, Hristova L. Study of self-reported hypersensitivity to electromagnetic fields in California. Environ Health Perspect. 110 Suppl 4:619-623, 2002.

Cases of alleged hypersensitivity to electromagnetic fields (EMFs) have been reported for more than 20 years, and some authors have suggested some connection with the "multiple chemical sensitivity" illness. We report the results of a telephone survey among a sample of 2,072 Californians. Being "allergic or very sensitive" to being near electrical devices was reported by 68 subjects, resulting in an adjusted prevalence of 3.2% (95% confidence interval = 2.8, 3.7).

Twenty-seven subjects (1.3%) reported sensitivity to electrical devices but no sensitivity to chemicals. Characteristics of the people reporting hypersensitivity to EMFs were generally different from those of people reporting being allergic to everyday chemicals. Alleging environmental illness or multiple chemical sensitivity diagnosed by a doctor was the strongest predictor of reporting being hypersensitive to EMFs in this population. Other predictive factors apart from self-reporting chemical sensitivity were race/ethnicity other than White, Black, or Hispanic; having low income; and being unable to work. The perception of risk of exposure to EMFs through the use of hair dryers (vs. exposure to power and distribution lines) was the factor the most associated with self-reporting about hypersensitivity to EMFs. However, risk perception was not sufficient to explain the characteristics of people reporting this disorder.

Lidén S, Reizenstein P, Sedvall G, Ehn L. [A study and treatment of a group of patients with electro-hypersensitivity. More than half of the patients were able to return to work]. Lakartidningen. 93(23):2265-2268, 1996. [Article in Swedish] (no abstract available)

Lonne-Rahm S, Andersson B, Melin L, Schultzberg M, Arnetz B, Berg M. Provocation with stress and electricity of patients with "sensitivity to electricity". J Occup Environ Med. 42(5):512-516, 2000.

Twenty-four patients with self-reported "sensitivity to electricity" were divided into two groups and tested in a double-blind provocation study. These patients, who reported increased skin symptoms when exposed to electromagnetic fields, were compared with 12 age- and sex-matched controls. Both groups were exposed to 30-minute periods of high or low stress situations, with and without simultaneous exposure to electromagnetic fields from a visual display unit. The matched controls were tested twice and given the same exposure as the patients but had the fields turned on every time. Stress was induced by requiring the participants to act in accordance with a random sequence of flashing lights while simultaneously solving complicated mathematical problems. Blood samples were analyzed for levels of the stress-related hormones melatonin, prolactin, adrenocorticotrophic hormone, neuropeptide Y, and growth hormone, and the expression of different peptides, cellular markers, and cytokines (somatostatin, CD1, factor XIIIa, and tumor necrosis factor-alpha). Skin biopsies were also analyzed for the occurrence of mast cells. Stress provocation resulted in feelings of more intense mental stress and elevated heart rate. The patients reported increased skin symptoms when they knew or believed that the electromagnetic field was turned on. With the blind conditions there were no differences between "on" or "off." Inflammatory mediators and mast cells in the skin were not affected by the stress exposure or by exposure to electromagnetic fields. The main conclusion was that the patients did not react to the fields.

Lyskov E, Sandström M, Hansson Mild K. Neurophysiological study of patients with perceived 'electrical hypersensitivity'. Int J Psychophysiol. 42(3):233-241, 2001.

The aim of the present study was to investigate baseline neurophysiological characteristics of the central and autonomous regulation and their reactivity to different tests in a group of persons with so-called 'electrical hypersensitivity', which is often considered as a form of psychosomatic disorders. Twenty patients with combinations of neuroasthenic symptoms (general fatigue, weakness, dizziness, headache) and facial skin (itching, tingling, redness) have been

investigated. An equal number of symptom-free persons served as a control group. The examination comprised self-reported measures, testing of visual functions, measurements of blood pressure, heart rate and its variability, electrodermal activity, respiration, EEG and visual evoked potentials (VEP). Several variables were found to differ between the patient and the control groups. The mean value of heart rate in rest condition was higher in the patient group compared to the controls (mean value of inter-beat intervals were 0.80 and 0.90 s, respectively). Heart rate variability and response to standing test were decreased in the patient group compared to the controls. Patients had faster onset, higher amplitudes, and left-right hand asymmetry of the sympathetic skin responses. They had a higher critical fusion frequency (43 vs. 40 Hz), and a trend to increased amplitude of steady-state VEPs at stimulation frequencies of 30-70 Hz. The data indicated that the observed group of patients had a trend to hyper sympathotone, hyperresponsiveness to sensor stimulation and heightened arousal.

Lyskov E, Sandström M, Mild KH. Provocation study of persons with perceived electrical hypersensitivity and controls using magnetic field exposure and recording of electrophysiological characteristics. Bioelectromagnetics. 22(7):457-462, 2001.

The aim of the present study was to investigate possible neurophysiological effects of intermittent 15 sec on/off cycle, 60 Hz, 10 microT magnetic field exposure on patients with perceived "electromagnetic hypersensitivity" (EHS), and control subjects during rest and performance of a mental arithmetic task. Twenty participants (15 female, 5 male, 31-60 years old, mean 45.8 +/- 0.7 years) were invited from the group of EHS patients. Twenty volunteers (15 female, 5 male, 31-59 years old, mean 45.0 +/- 0.7 years?) served as a control group. The test protocol consisted of a set of examinations: EEG, visual evoked potentials, electrodermal activity, ECG, and blood pressure. The total duration of the test was 40 min, divided into two 10 min rest periods and two 10 min periods of mathematical performance. Magnetic field and sham exposures were presented randomly during these periods, resulting in four different conditions: Field-Rest, Sham-Rest, Field-Math, and Sham-Math. The data showed significant main effects of the Group factor (EHS vs. control subjects) on heart rate ($F(1,80) = 20.6$; $P < 0.01$), heart rate spectrum ratio ($F(1,80) = 9.5$; $P = 0.02$), and electrodermal activity ($F(1,76) = 4.2$; $P = 0.04$), whereas EEG characteristics did not differ between groups. The Condition factor (mathematical task vs. relaxed) showed main effects for heart rate ($F(1,80) = 14.8$; $P < 0.01$), heart rate spectrum ratio ($F(1,80) = 7.8$; $P = 0.06$), electrodermal activity ($F(1,76) = 56.8$; $P < 0.01$), and alpha and theta spectral bands of EEG. Magnetic field exposure did not affect autonomous system or electroencephalographic variables of either group. These data do not indicate that EHS patients or control are affected by low-level 60 Hz magnetic field exposure. However, persons reporting EHS differed from the control subjects in baseline values of investigated physiological characteristics. Perhaps EHS patients have a rather distinctive physiological predisposition to sensitivity to physical and psychosocial environmental stressors.

Manjunatha N, Jayaram N, Benegal V, Murthy P. Idiopathic environmental intolerance (electromagnetic hypersensitivity syndrome). Natl Med J India. 24(5):314, 2011. (Correspondence, no abstract available)

Markovà E, Hillert L, Malmgren L, Persson BR, Belyaev IY. Microwaves from GSM mobile telephones affect 53BP1 and gamma-H2AX foci in human lymphocytes from hypersensitive and healthy persons. Environ Health Perspect. 113(9):1172-1177, 2005.

The data on biologic effects of nonthermal microwaves (MWs) from mobile telephones are diverse, and these effects are presently ignored by safety standards of the International Commission for Non-Ionizing Radiation Protection (ICNIRP). In the present study, we

investigated effects of MWs of Global System for Mobile Communication (GSM) at different carrier frequencies on human lymphocytes from healthy persons and from persons reporting hypersensitivity to electromagnetic fields (EMFs). We measured the changes in chromatin conformation, which are indicative of stress response and genotoxic effects, by the method of anomalous viscosity time dependence, and we analyzed tumor suppressor p53-binding protein 1 (53BP1) and phosphorylated histone H2AX (gamma-H2AX), which have been shown to colocalize in distinct foci with DNA double-strand breaks (DSBs), using immunofluorescence confocal laser microscopy. We found that MWs from GSM mobile telephones affect chromatin conformation and 53BP1/gamma-H2AX foci similar to heat shock. For the first time, we report here that effects of MWs from mobile telephones on human lymphocytes are dependent on carrier frequency. On average, the same response was observed in lymphocytes from hypersensitive and healthy subjects.

McCarty DE, Carrubba S, Chesson AL, Frilot C, Gonzalez-Toledo E, Marino AA. Electromagnetic hypersensitivity: evidence for a novel neurological syndrome. Int J Neurosci. 121(12):670-676, 2011.

OBJECTIVE: We sought direct evidence that acute exposure to environmental-strength electromagnetic fields (EMFs) could induce somatic reactions (EMF hypersensitivity). **METHODS:** The subject, a female physician self-diagnosed with EMF hypersensitivity, was exposed to an average (over the head) 60-Hz electric field of 300 V/m (comparable with typical environmental-strength EMFs) during controlled provocation and behavioral studies. **RESULTS:** In a double-blinded EMF provocation procedure specifically designed to minimize unintentional sensory cues, the subject developed temporal pain, headache, muscle twitching, and skipped heartbeats within 100 s after initiation of EMF exposure ($p < .05$). The symptoms were caused primarily by field transitions (off-on, on-off) rather than the presence of the field, as assessed by comparing the frequency and severity of the effects of pulsed and continuous fields in relation to sham exposure. The subject had no conscious perception of the field as judged by her inability to report its presence more often than in the sham control. **DISCUSSION:** The subject demonstrated statistically reliable somatic reactions in response to exposure to subliminal EMFs under conditions that reasonably excluded a causative role for psychological processes. **CONCLUSION:** EMF hypersensitivity can occur as a bona fide environmentally inducible neurological syndrome.

Medeiros LN, Sanchez TG. Tinnitus and cell phones: the role of electromagnetic radiofrequency radiation. Brazilian Journal of Otorhinolaryngology. 82(1):97-104. January–February 2016. doi:10.1016/j.bjorl.2015.04.013

Introduction Tinnitus is a multifactorial condition and its prevalence has increased on the past decades. The worldwide progressive increase of the use of cell phones has exposed the peripheral auditory pathways to a higher dose of electromagnetic radiofrequency radiation (EMRFR). Some tinnitus patients report that the abusive use of mobiles, especially when repeated in the same ear, might worsen ipsilateral tinnitus. **Objective** The aim of this study was to evaluate the available evidence about the possible causal association between tinnitus and exposure to electromagnetic waves. **Methods** A literature review was performed searching for the following keywords: tinnitus, electromagnetic field, mobile phones, radio frequency, and electromagnetic hypersensitivity. We selected 165 articles that were considered clinically relevant in at least one of the subjects. **Results** EMRFR can penetrate exposed tissues and safety exposure levels have been established. These waves provoke proved thermogenic effects and potential biological and genotoxic effects. Some individuals are more sensitive to

electromagnetic exposure (electrosensitivity), and thus, present earlier symptoms. There may be a common pathophysiology between this electrosensitivity and tinnitus. Conclusion There are already reasonable evidences to suggest caution for using mobile phones to prevent auditory damage and the onset or worsening of tinnitus.

Meg Tseng MC, Lin YP, Cheng TJ. Prevalence and psychiatric comorbidity of self-reported electromagnetic field sensitivity in Taiwan: a population-based study. J Formos Med Assoc. 110(10):634-641, 2011.

BACKGROUND/PURPOSE: Psychological factors have been implicated in the etiology of idiopathic environmental illness in many studies. Few studies have ever reported psychiatric morbidity among individuals with electromagnetic hypersensitivity. We aimed to estimate the prevalence and identify the associated factors of self-reported electromagnetic field sensitivity (SREMFS) in adults of Taiwan. **METHODS:** A total of 1251 adults selected from a nationwide Computer-Assisted Telephone Interviewing system received a telephone survey about the perception of risk from various environmental agents and their effects on health and well-being. **RESULTS:** The estimated prevalence of people with SREMFS was 13.3 % (95% confidence interval: 11.2-15.3). People aged >65 years were associated with a lower risk of reporting sensitivity to electromagnetic fields, whereas people with a very poor self-reported health status, those who were unable to work, and those who had psychiatric morbidity were associated with a higher risk of having SREMFS. **CONCLUSION:** The prevalence of SREMFS in the general population of Taiwan is higher than that reported in western countries. People with psychiatric morbidity are more likely to report sensitivity to electromagnetic fields. The cross-sectional design precludes the causal inference of all identified correlates and electromagnetic field sensitivity.

Mortazavi SM, Ahmadi J, Shariati M. Prevalence of subjective poor health symptoms associated with exposure to electromagnetic fields among university students. Bioelectromagnetics. 28(4):326-330, 2007. Erratum in Bioelectromagnetics. 28(5):392, 2007.

The number of people complaining about different symptoms that may be associated with exposure to electromagnetic fields (EMF) has increased rapidly during past years. Students use both mobile phones and video display terminals frequently. The purpose of this study was to investigate the association of mobile phone use and EMF health hazards. Basic demographic data and self-reported symptoms were sought using a questionnaire administered to all apparently healthy students at Rafsanjan University of Medical Sciences (RUMS) and Vali-e-Asr University (VAU). Questions about some major confounding factors such as age, gender, amount of video display terminal work were also included. Exact Fischer Test was used for data analysis. Among self-reported symptoms, headache (53.5%), fatigue (35.6%), difficulties in concentration (32.5%), vertigo/dizziness (30.4%), attention disorders (28.8%), nervousness (28.1%), palpitation (14.7%), low back pain (14.3%), myalgia (12.4%), and tinnitus (9.9%) were the main self-reported symptoms. No significant differences in the prevalence of these symptoms were found between CRT users and those who did not use CRTs. A significant association was found between cordless phone use and difficulties in concentration ($P < .05$) or attention disorders ($P < .05$). However, after correction of the gender role, these differences were not significant. No association was found between mobile phone use and the above-mentioned symptoms. No significantly higher prevalence of self-reported symptoms was found in individuals who had used mobile phones, video display terminals or cordless phones more frequently than others. Mass-media's lack of interest in the possible hazards of exposure to EMF in developing countries can explain the difference observed between the results of this study and those of other researchers in some developed countries who have shown an

association between EMF exposure and the prevalence of self-reported subjective symptoms. This finding can confirm the results obtained in provocative studies which indicated the role of psychological factors in electromagnetic hypersensitivity. More research is needed to clarify whether daily environmental EMF may cause health problems.

Mortazavi SM, Mahbudi A, Atefi M, Bagheri Sh, Bahaedini N, Besharati A. An old issue and a new look: electromagnetic hypersensitivity caused by radiations emitted by GSM mobile phones. Technol Health Care. 19(6):435-443, 2011.

University students use mobile phones frequently. We previously showed that there was no association between mobile phone use and EMF health hazards among university students. As our previous study was based only on self-reported symptoms this double-blind study was designed to answer two basic questions. Firstly, are self-reported hypersensitive individuals capable of sensing whether there is a real/sham microwave exposure? Secondly, do hypersensitive patients show alterations in their biological parameters such as heart rate, respiration, and blood pressure during microwave exposure? The study consisted of a preliminary screening phase and two subsequent complementary phases. In the 1st phase, 700 students were screened for EMF hypersensitivity. Fifty two participants were hypersensitive individuals but after applying the exclusion criteria only 28 students were invited to take part in the 2nd and 3rd phase of the study, but only 20 students (71.4%) declared their informed consent. In the 2nd phase, these self reported hypersensitive participants, were exposed/sham exposed to microwave radiation emitted from a mobile phone for 10 minutes and they were asked if they could sense the existence of microwave radiation. In the 3rd phase, all students were connected to ICU monitoring devices and their basic physiological parameters were recorded precisely. Among self-reported symptoms reported in our previous study, in this study only problem in concentration ($P < 0.05$) and low back pain ($P < 0.05$) were associated with mobile phone use. Furthermore, there was a significant association between the location of mobile phone during talk and the overall score of the severity of the symptoms ($P < 0.001$). When the participants were asked to report their perception about the real and sham exposures, only 5 students (25%) could discriminate the real exposure/sham exposure phases. This relative frequency can be only due to chance. In the 3rd phase all of the 20 participants were connected to intensive care unit monitors and the changes in their heart rate, respiration, and blood pressure during real/sham exposure were recorded. No statistically significant changes between the means of these parameters in real/sham exposure were observed. Our findings clearly confirm the results obtained in other provocative studies. These data also indicate the possible role of psychological factors in electromagnetic hypersensitivity.

Mueller CH, Krueger H, Schierz C. Project NEMESIS: perception of a 50 Hz electric and magnetic field at low intensities (laboratory experiment). Bioelectromagnetics. 23(1):26-36, 2002.

The Electrical Hypersensitivity Syndrome (EHS) is a condition where people suffer from various nonspecific health symptoms attributed to an assumed adverse effect of electric and magnetic fields (EMF). Many EHS patients report the ability to consciously perceive EMF at very low intensities. The existence of a direct EMF perception could be the key to explain at least partially the aetiology of EHS through stress mechanisms and allow the comparison with well known environmental stressors such as noise or odor. The double blind laboratory experiment tested the hypothesis that there are subjects with the ability to perceive 50 Hz EMF at 100 V/m and 6 microT (EMF sensitive) and to investigate the prevalence of EMF sensitivity in a group consisting of subjects with or without self-reported EHS. A total of 63 volunteers, 49 with EHS

and 14 controls, took part in the EMF perception experiment, where 10 sham and 10 exposed 2 min blocks had to be judged in randomized sequence (field on/field off). Seven out of 63 subjects reached a statistically significant result which points to the existence of a small EMF sensitive subgroup within the study group. There was no relevant difference between the subjects with self reported EHS and those without in terms of the success rate in the field perception experiment, as well as the number and types of symptoms encountered during the test. The results of the EMF perception experiment suggest that EHS is not a prerequisite for the ability to consciously perceive weak EMF and vice versa.

Nam KC, Kim SW, Kim SC, Kim DW. Effects of RF exposure of teenagers and adults by CDMA cellular phones. Bioelectromagnetics. 27(7):509-514, 2006.

Many cellular phone provocation studies have been conducted since the question of increased health risk from extended usage of cellular phones became a social issue. Internationally, most studies have been conducted regarding the effects of GSM cellular phones on blood pressure and heart rate of adult volunteers. On the other hand, very few provocation studies have been conducted regarding the physiological effects of CDMA phones on teenagers. In this study, two volunteer groups consisting of 21 teenagers and 21 adults were exposed to 300 mW of radio frequency (RF) electromagnetic field emitted by a CDMA cellular phone for half an hour. Physiological parameters such as systolic and diastolic blood pressures, heart rate, respiration rate, and skin resistance were simultaneously measured. All the parameters for both groups were unaffected during the exposure except for decreased skin resistance of the teenager group ($P < .0001$). For the regrouped 23 male and 19 female subjects, all the parameters for both groups were unaffected during the exposure except for decreased skin resistance of the male subjects ($P = .0026$). Those resistances at 10 min after the terminated exposure returned to the resistances at rest regardless of the different groups of age and sex.

Nam KC, Lee JH, Noh HW, Cha EJ, Kim NH, Kim DW. Hypersensitivity to RF fields emitted from CDMA cellular phones: a provocation study. Bioelectromagnetics. 30(8):641-650, 2009.

With the number of cellular phone users rapidly increasing, there is a considerable amount of public concern regarding the effects that electromagnetic fields (EMFs) from cellular phones have on health. People with self-attributed electromagnetic hypersensitivity (EHS) complain of subjective symptoms such as headaches, insomnia, and memory loss, and attribute these symptoms to radio frequency (RF) radiation from cellular phones and/or base stations. However, EHS is difficult to diagnose because it relies on a person's subjective judgment. Various provocation studies have been conducted on EHS caused by Global System for Mobile Communications (GSM) phones in which heart rate and blood pressure or subjective symptoms were investigated. However, there have been few sham-controlled provocation studies on EHS with Code Division Multiple Access (CDMA) phones where physiological parameters, subjective symptoms, and perception of RF radiation for EHS and non-EHS groups were simultaneously investigated. In this study, two volunteer groups of 18 self-reported EHS and 19 non-EHS persons were tested for both sham and real RF exposure from CDMA cellular phones with a 300 mW maximum exposure that lasted half an hour. We investigated not only the physiological parameters such as heart rate, respiration rate, and heart rate variability (HRV), but also various subjective symptoms and the perception of EMF. In conclusion, RF exposure did not have any effects on physiological parameters or subjective symptoms in either group. As for EMF perception, there was no evidence that the EHS group better perceived EMF than the non-EHS group.

Nam KC, Choi JL, Kwon MK, Jang KH, Kim DW. Physiological variables and subjective symptoms by 60 Hz magnetic field in EHS and non-EHS persons. Conf Proc IEEE Eng Med Biol Soc. 2011:1925-1928, 2011.

Electromagnetic hypersensitivity (EHS) is a set of claims of adverse medical symptoms self attributed by exposure to electromagnetic field. In this study, we simultaneously investigated both physiological changes (heart rate, respiration rate, and heart rate variability) and subjective symptoms to determine the origin of EHS. Two volunteer groups (15 self-reported EHS and 16 non-EHS participants) were tested under both sham and real exposure to 12.5 μ T magnetic fields at 60 Hz that lasted a half an hour. The magnetic field exposure did not have any effect on physiological variables or subjective symptoms in either group. We conclude that the subjective symptoms did not result from exposure to 12.5 μ T magnetic field at 60 Hz.

Nieto-Hernandez R, Rubin GJ, Cleare AJ, Weinman JA, Wessely S. Can evidence change belief? Reported mobile phone sensitivity following individual feedback of an inability to discriminate active from sham signals. J Psychosom Res. 65(5):453-460, 2008.

OBJECTIVE: In this study, we tested whether providing individuals, who described being sensitive to mobile phone signals, with accurate feedback about their ability to discriminate an active mobile phone signal from a sham signal had any impact on their subsequent symptom levels or their perceived sensitivity to mobile phones. METHODS: Sixty-nine participants who reported sensitivity to mobile phones took part in a double-blind, placebo-controlled provocation study. Perceived sensitivity to mobile phones was assessed using a version of the Sensitive Soma Assessment Scale (SSAS) and the severity of any symptoms attributed to mobile phones was recorded. Both the overall ("negative") findings of the provocation study and the participant's own individual results ("correct" or "incorrect" at detecting a mobile phone signal) were then described to them. Six months later, perceived sensitivity and symptom severity were measured again. RESULTS: Fifty-eight participants (84%) received feedback and participated in the 6-month follow-up. No significant differences in SSAS scores or in symptom severity scores were found between individuals told that they were correct (n=31) or incorrect (n=27) in their ability to detect mobile phone signals in the provocation study. CONCLUSION: The provision of accurate feedback was insufficient to change attributions or reduce symptoms in this study. However, an overtly negative reaction to feedback was not observed among most participants, and some participants were willing to consider that factors other than electromagnetic field may be relevant in causing or exacerbating their symptoms. Discussing possible psychological factors with electromagnetic hypersensitivity patients may be beneficial for some.

Nordin S, Neely G, Olsson D, Sandström M. Odor and Noise Intolerance in Persons with Self-Reported Electromagnetic Hypersensitivity. Int J Environ Res Public Health. 11(9):8794-8805, 2014.

Lack of confirmation of symptoms attributed to electromagnetic fields (EMF) and triggered by EMF exposure has highlighted the role of individual factors. Prior observations indicate intolerance to other types of environmental exposures among persons with electromagnetic hypersensitivity (EHS). This study assessed differences in odor and noise intolerance between persons with EHS and healthy controls by use of subscales and global measures of the Chemical Sensitivity Scale (CSS) and the Noise Sensitivity Scale (NSS). The EHS group scored significantly higher than the controls on all CSS and NSS scales. Correlation coefficients between CSS and NSS scores ranged from 0.60 to 0.65 across measures. The findings suggest an association between EHS and odor and noise intolerance, encouraging further investigation of individual factors for understanding EMF-related symptoms.

Redmayne M, Johansson O. Could myelin damage from radiofrequency electromagnetic field exposure help explain the functional impairment electrohypersensitivity? A review of the evidence. J Toxicol Environ Health B Crit Rev. 17(5):247-258, 2014.

Myelin provides the electrical insulation for the central and peripheral nervous system and develops rapidly in the first years of life, but continues into mid-life or later. Myelin integrity is vital to healthy nervous system development and functioning. This review outlines the development of myelin through life, and then considers the evidence for an association between myelin integrity and exposure to low-intensity radiofrequency electromagnetic fields (RF-EMFs) typical in the modern world. In RF-EMF peer-reviewed literature examining relevant impacts such as myelin sheath, multiple sclerosis, and other myelin-related diseases, cellular examination was included. There are surprisingly little data available in each area, but considered together a picture begins to emerge in RF-EMF-exposed cases: (1) significant morphological lesions in the myelin sheath of rats; (2) a greater risk of multiple sclerosis in a study subgroup; (3) effects in proteins related to myelin production; and (4) physical symptoms in individuals with functional impairment electrohypersensitivity, many of which are the same as if myelin were affected by RF-EMF exposure, giving rise to symptoms of demyelination. In the latter, there are exceptions; headache is common only in electrohypersensitivity, while ataxia is typical of demyelination but infrequently found in the former group. Overall, evidence from in vivo and in vitro and epidemiological studies suggests an association between RF-EMF exposure and either myelin deterioration or a direct impact on neuronal conduction, which may account for many electrohypersensitivity symptoms. The most vulnerable are likely to be those in utero through to at least mid-teen years, as well as ill and elderly individuals.

Regel SJ, Negovetic S, Rösli M, Berdiñas V, Schuderer J, Huss A, Lott U, Kuster N, Achermann P. UMTS base station-like exposure, well-being, and cognitive performance. Environ Health Perspect. 114(8):1270-1275, 2006.

BACKGROUND: Radio-frequency electromagnetic fields (RF EMF) of mobile communication systems are widespread in the living environment, yet their effects on humans are uncertain despite a growing body of literature. **OBJECTIVES:** We investigated the influence of a Universal Mobile Telecommunications System (UMTS) base station-like signal on well-being and cognitive performance in subjects with and without self-reported sensitivity to RF EMF. **METHODS:** We performed a controlled exposure experiment (45 min at an electric field strength of 0, 1, or 10 V/m, incident with a polarization of 45 degrees from the left back side of the subject, weekly intervals) in a randomized, double-blind crossover design. A total of 117 healthy subjects (33 self-reported sensitive, 84 nonsensitive subjects) participated in the study. We assessed well-being, perceived field strength, and cognitive performance with questionnaires and cognitive tasks and conducted statistical analyses using linear mixed models. Organ-specific and brain tissue-specific dosimetry including uncertainty and variation analysis was performed. **RESULTS:** In both groups, well-being and perceived field strength were not associated with actual exposure levels. We observed no consistent condition-induced changes in cognitive performance except for two marginal effects. At 10 V/m we observed a slight effect on speed in one of six tasks in the sensitive subjects and an effect on accuracy in another task in nonsensitive subjects. Both effects disappeared after multiple end point adjustment. **CONCLUSIONS:** In contrast to a recent Dutch study, we could not confirm a short-term effect of UMTS base station-like exposure on well-being. The reported effects on brain functioning were marginal and may have occurred by chance. Peak spatial absorption in brain tissue was considerably smaller than during use of a mobile phone. No conclusions can be drawn

regarding short-term effects of cell phone exposure or the effects of long-term base station-like exposure on human health.

Riddervold IS, Pedersen GF, Andersen NT, Pedersen AD, Andersen JB, Zachariae R, Mølhave L, Sigsgaard T, Kjaergaard SK. Cognitive function and symptoms in adults and adolescents in relation to rf radiation from UMTS base stations. Bioelectromagnetics. 29(4):257-267, 2008.

There is widespread public concern about the potential adverse health effects of mobile phones in general and their associated base stations in particular. This study was designed to investigate the acute effects of radio frequency (RF) electromagnetic fields (EMF) emitted by the Universal Mobile Telecommunication System (UMTS) mobile phone base stations on human cognitive function and symptoms. Forty adolescents (15-16 years) and 40 adults (25-40 years) were exposed to four conditions: (1) sham, (2) a Continuous Wave (CW) at 2140 MHz, (3) a signal at 2140 MHz modulated as UMTS and (4) UMTS at 2140 MHz including all control features in a randomized, double blinded cross-over design. Each exposure lasted 45 min. During exposure the participants performed different cognitive tasks with the Trail Making B (TMB) test as the main outcome and completed a questionnaire measuring self reported subjective symptoms. No statistically significant differences between the UMTS and sham conditions were found for performance on TMB. For the adults, the estimated difference between UMTS and sham was -3.2% (-9.2%; 2.9%) and for the adolescents 5.5% (-1.1%; 12.2%). No significant changes were found in any of the cognitive tasks. An increase in 'headache rating' was observed when data from the adolescents and adults were combined ($P = 0.027$), an effect that may be due to differences at baseline. In conclusion, the primary hypothesis that UMTS radiation reduces general performance in the TMB test was not confirmed. However, we suggest that the hypothesis of subjective symptoms and EMF exposure needs further research.

Röösli M, Moser M, Baldinini Y, Meier M, Braun-Fahrlander C. Symptoms of ill health ascribed to electromagnetic field exposure--a questionnaire survey. Int J Hyg Environ Health. 207(2):141-150, 2004.

From June 2001, health questionnaires were distributed to people who complained about symptoms of ill health which they ascribed to exposure to electromagnetic fields (EMF). The objective of the survey was to gain a better knowledge of the anxieties of complainants, to obtain hints of possible problems and of actions that should be taken to solve the problems. The survey was not designed to establish a causal association between exposure to EMF and symptoms of ill health. Within one year, 429 questionnaires were returned of which 394 persons reported symptoms. The average age of the complainants was 51.0 years and 57 percent were female. The complainants were older, had a higher educational level and were more likely to be married compared to the general Swiss population. A mean of 2.7 different symptoms were reported. Sleep disorders (58%), headaches (41%), nervousness or distress (19%), fatigue (18%), and concentration difficulties (16%) were most common complaints. Complainants related their symptoms most frequently to exposure to mobile phone base stations (74%), followed by mobile phones (36%), cordless phones (29%) and power lines (27%). No distinct symptoms related to a specific field source could be identified. Eighty-five percent of the people who consulted a public authority because of their symptoms were unsatisfied with the response, whereas consultation of self-help groups or building ecologists usually fulfilled expectations. Two thirds of complainants had taken some action to reduce their symptoms. The most

common measure was to avoid exposure if possible. Removing or disconnecting indoor sources was judged to be the most effective action.

Röösli M. Radiofrequency electromagnetic field exposure and non-specific symptoms of ill health: a systematic review. *Environ Res.* 107(2):277-287, 2008.

This article is a systematic review of whether everyday exposure to radiofrequency electromagnetic field (RF-EMF) causes symptoms, and whether some individuals are able to detect low-level RF-EMF (below the ICNIRP [International Commission on Non-Ionizing Radiation Protection] guidelines). Peer-reviewed articles published before August 2007 were identified by means of a systematic literature search. Meta-analytic techniques were used to pool the results from studies investigating the ability to discriminate active from sham RF-EMF exposure. RF-EMF discrimination was investigated in seven studies including a total of 182 self-declared electromagnetic hypersensitive (EHS) individuals and 332 non-EHS individuals. The pooled correct field detection rate was 4.2% better than expected by chance (95% CI: -2.1 to 10.5). There was no evidence that EHS individuals could detect presence or absence of RF-EMF better than other persons. There was little evidence that short-term exposure to a mobile phone or base station causes symptoms based on the results of eight randomized trials investigating 194 EHS and 346 non-EHS individuals in a laboratory. Some of the trials provided evidence for the occurrence of placebo effects. In population based studies an association between symptoms and exposure to RF-EMF in the everyday environment was repeatedly observed. This review showed that the large majority of individuals who claims to be able to detect low level RF-EMF are not able to do so under double-blind conditions. If such individuals exist, they represent a small minority and have not been identified yet. The available observational studies do not allow differentiating between biophysical from EMF and placebo effects.

Röösli M, Moser M, Baldinini Y, Meier M, Braun-Fahrlander C. Symptoms of ill health ascribed to electromagnetic field exposure--a questionnaire survey. *Int J Hyg Environ Health.* 207(2):141-150, 2004.

From June 2001, health questionnaires were distributed to people who complained about symptoms of ill health which they ascribed to exposure to electromagnetic fields (EMF). The objective of the survey was to gain a better knowledge of the anxieties of complainants, to obtain hints of possible problems and of actions that should be taken to solve the problems. The survey was not designed to establish a causal association between exposure to EMF and symptoms of ill health. Within one year, 429 questionnaires were returned of which 394 persons reported symptoms. The average age of the complainants was 51.0 years and 57 percent were female. The complainants were older, had a higher educational level and were more likely to be married compared to the general Swiss population. A mean of 2.7 different symptoms were reported. Sleep disorders (58%), headaches (41%), nervousness or distress (19%), fatigue (18%), and concentration difficulties (16%) were most common complaints. Complainants related their symptoms most frequently to exposure to mobile phone base stations (74%), followed by mobile phones (36%), cordless phones (29%) and power lines (27%). No distinct symptoms related to a specific field source could be identified. Eighty-five percent of the people who consulted a public authority because of their symptoms were unsatisfied with the response, whereas consultation of self-help groups or building ecologists usually fulfilled expectations. Two thirds of complainants had taken some action to reduce their symptoms. The most common measure was to avoid exposure if possible. Removing or disconnecting indoor sources was judged to be the most effective action.

Rubin GJ, Das Munshi J, Wessely S. Electromagnetic hypersensitivity: a systematic review of provocation studies. *Psychosom Med.* 67(2):224-232, 2005.

OBJECTIVES: The objectives of this study were to assess whether people who report hypersensitivity to weak electromagnetic fields (EMFs) are better at detecting EMF under blind or double-blind conditions than nonhypersensitive individuals, and to test whether they respond to the presence of EMF with increased symptom reporting. **METHODS:** An extensive systematic search was used to identify relevant blind or double-blind provocation studies. This involved searching numerous literature databases and conference proceedings, and examining the citations of reviews and included studies. The results of relevant studies were tabulated and metaanalyses were used to compare the proportions of "hypersensitive" and control participants able to discriminate active from sham EMF exposures. **RESULTS:** Thirty-one experiments testing 725 "electromagnetically hypersensitive" participants were identified. Twenty-four of these found no evidence to support the existence of a biophysical hypersensitivity, whereas 7 reported some supporting evidence. For 2 of these 7, the same research groups subsequently tried and failed to replicate their findings. In 3 more, the positive results appear to be statistical artefacts. The final 2 studies gave mutually incompatible results. Our metaanalyses found no evidence of an improved ability to detect EMF in "hypersensitive" participants. **CONCLUSIONS:** The symptoms described by "electromagnetic hypersensitivity" sufferers can be severe and are sometimes disabling. However, it has proved difficult to show under blind conditions that exposure to EMF can trigger these symptoms. This suggests that "electromagnetic hypersensitivity" is unrelated to the presence of EMF, although more research into this phenomenon is required.

Rubin GJ, Das Munshi J, Wessely S. A systematic review of treatments for electromagnetic hypersensitivity. *Psychother Psychosom.* 75(1):12-18, 2006.

BACKGROUND: Electromagnetic hypersensitivity (EHS) is a poorly understood condition in which patients report symptoms following perceived exposure to weak electromagnetic fields (EMFs) such as those produced by mobile phones or visual display units. Little is known about the aetiology of the condition although experimental data suggest that EMFs are an unlikely causal agent. In this systematic review we assessed the efficacy of any treatment for people reporting EHS. **METHODS:** Twelve literature databases were examined to identify relevant studies. We also hand-searched conference proceedings and examined the reference sections of reviews and other papers. Only clinical trials that compared the efficacy of a potential treatment for EHS against a control condition were included in the review. **RESULTS:** Nine controlled clinical trials were identified, examining the effects of cognitive behavioural therapy (4 studies), visual display unit screen filters (2 studies), 'shielding' EMF emitters (1 study), supplementary antioxidant therapy (1 study) and acupuncture (1 study). The quality of these studies was limited. Nevertheless, their results suggest that cognitive behavioural therapy is more effective than providing no treatment. None of the other therapies have had their efficacy adequately demonstrated. **CONCLUSIONS:** The evidence base concerning treatment options for EHS is limited and more research is needed before any definitive clinical recommendations can be made. However, the best evidence currently available suggests that cognitive behavioural therapy is effective for patients who report being hypersensitive to weak EMFs.

Rubin GJ, Cleare AJ, Wessely S. Psychological factors associated with self-reported sensitivity to mobile phones. *J Psychosom Res.* 64(1):1-9; discussion 11-12, 2008

OBJECTIVE: Some people report symptoms associated with mobile phone use. A minority also report "electrosensitivity," experiencing symptoms following exposure to other electrical devices. Research suggests that electromagnetic fields do not trigger these symptoms. In this study, we examined the differences between these two "sensitive" groups and healthy controls.

METHODS: Fifty-two people who reported sensitivity to mobile phones, 19 people who reported sensitivity to mobile phones and "electrosensitivity," and 60 nonsensitive controls completed a questionnaire assessing the following: primary reason for using a mobile phone, psychological health, symptoms of depression, modern health worries (MHW), general health status, symptom severity, and the presence of other medically unexplained syndromes. **RESULTS:** Perceived sensitivity was associated with an increased likelihood of using a mobile phone predominantly for work (3% of controls, 13% of those sensitive to mobile phones, and 21% of those reporting "electrosensitivity") and greater MHW concerning radiation [mean (S.D.) on a scale of 1-5: 2.0 (1.0), 2.7 (0.9), and 4.0 (0.8), respectively]. Participants who reported "electrosensitivity" also experienced greater depression, greater worries about tainted food and toxic interventions, worse general health on almost every measure, and a greater number of other medically unexplained syndromes compared to participants from the other two groups. No group differences were observed with regards to psychiatric cases. **CONCLUSIONS:** The data illustrate that patients reporting "electrosensitivity" experience substantially worse health than either healthy individuals or people who report sensitivity to mobile phones but who do not adopt the label "electrosensitivity." Clinicians and researchers would be wise to pay greater attention to this subdivision.

Rubin GJ, Nieto-Hernandez R, Wessely S. Idiopathic environmental intolerance attributed to electromagnetic fields (formerly 'electromagnetic hypersensitivity'): An updated systematic review of provocation studies. Bioelectromagnetics. 31(1):1-11, 2010.

Idiopathic Environmental Intolerance attributed to electromagnetic fields (IEI-EMF; formerly 'electromagnetic hypersensitivity') is a medically unexplained illness in which subjective symptoms are reported following exposure to electrical devices. In an earlier systematic review, we reported data from 31 blind provocation studies which had exposed IEI-EMF volunteers to active or sham electromagnetic fields and assessed whether volunteers could detect these fields or whether they reported worse symptoms when exposed to them. In this article, we report an update to that review. An extensive literature search identified 15 new experiments. Including studies reported in our earlier review, 46 blind or double-blind provocation studies in all, involving 1175 IEI-EMF volunteers, have tested whether exposure to electromagnetic fields is responsible for triggering symptoms in IEI-EMF. No robust evidence could be found to support this theory. However, the studies included in the review did support the role of the nocebo effect in triggering acute symptoms in IEI-EMF sufferers. Despite the conviction of IEI-EMF sufferers that their symptoms are triggered by exposure to electromagnetic fields, repeated experiments have been unable to replicate this phenomenon under controlled conditions. A narrow focus by clinicians or policy makers on bioelectromagnetic mechanisms is therefore, unlikely to help IEI-EMF patients in the long-term.

Rubin GJ, Hillert L, Nieto-Hernandez R, van Rongen E, Oftedal G. Do people with idiopathic environmental intolerance attributed to electromagnetic fields display physiological effects when exposed to electromagnetic fields? A systematic review of provocation studies. Bioelectromagnetics. 32(8):593-609, 2011.

Idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF) is a controversial illness in which people report symptoms that they believe are triggered by exposure to EMF. Double-blind experiments have found no association between the presence

of EMF and self-reported outcomes in people with IEI-EMF. No systematic review has assessed whether EMF exposure triggers physiological or cognitive changes in this group. Using a systematic literature search, we identified 29 single or double-blind experiments in which participants with IEI-EMF were exposed to different EMF levels and in which objectively measured outcomes were assessed. Five studies identified significant effects of exposure such as reduced heart rate and blood pressure, altered pupillary light reflex, reduced visual attention and perception, improved spatial memory, movement away from an EMF source during sleep and altered EEG during sleep. In most cases, these were isolated results that other studies failed to replicate. For the sleep EEG findings, the results reflected similar changes in the IEI-EMF participants and a non-IEI-EMF control group. At present, there is no reliable evidence to suggest that people with IEI-EMF experience unusual physiological reactions as a result of exposure to EMF. This supports suggestions that EMF is not the main cause of their ill health.

Sage C. The implications of non-linear biological oscillations on human electrophysiology for electrohypersensitivity (EHS) and multiple chemical sensitivity (MCS). Rev Environ Health. 2015 Sep 12.

The 'informational content' of Earth's electromagnetic signaling is like a set of operating instructions for human life. These environmental cues are dynamic and involve exquisitely low inputs (intensities) of critical frequencies with which all life on Earth evolved. Circadian and other temporal biological rhythms depend on these fluctuating electromagnetic inputs to direct gene expression, cell communication and metabolism, neural development, brainwave activity, neural synchrony, a diversity of immune functions, sleep and wake cycles, behavior and cognition. Oscillation is also a universal phenomenon, and biological systems of the heart, brain and gut are dependent on the cooperative actions of cells that function according to principles of non-linear, coupled biological oscillations for their synchrony. They are dependent on exquisitely timed cues from the environment at vanishingly small levels. Altered 'informational content' of environmental cues can swamp natural electromagnetic cues and result in dysregulation of normal biological rhythms that direct growth, development, metabolism and repair mechanisms. Pulsed electromagnetic fields (PEMF) and radiofrequency radiation (RFR) can have the devastating biological effects of disrupting homeostasis and desynchronizing normal biological rhythms that maintain health. Non-linear, weak field biological oscillations govern body electrophysiology, organize cell and tissue functions and maintain organ systems. Artificial bioelectrical interference can give false information (disruptive signaling) sufficient to affect critical pacemaker cells (of the heart, gut and brain) and desynchronize functions of these important cells that orchestrate function and maintain health. Chronic physiological stress undermines homeostasis whether it is chemically induced or electromagnetically induced (or both exposures are simultaneous contributors). This can eventually break down adaptive biological responses critical to health maintenance; and resilience can be compromised. Electrohypersensitivity can be caused by successive assaults on human bioelectrochemical dynamics from exogenous electromagnetic fields (EMF) and RFR or a single acute exposure. Once sensitized, further exposures are widely reported to cause reactivity to lower and lower intensities of EMF/RFR, at which point thousand-fold lower levels can cause adverse health impacts to the electrosensitive person. Electrohypersensitivity (EHS) can be a precursor to, or linked with, multiple chemical sensitivity (MCS) based on reports of individuals who first develop one condition, then rapidly develop the other. Similarity of chemical biomarkers is seen in both conditions [histamines, markers of oxidative stress, auto-antibodies, heat shock protein (HSP), melatonin markers and leakage of the blood-brain barrier]. Low intensity pulsed microwave activation of voltage-gated calcium channels (VGCCs) is postulated as a mechanism of action for non-thermal health effects.

Sandström M, Lyskov E, Berglund A, Medvedev S, Mild KH. Neurophysiological effects of flickering light in patients with perceived electrical hypersensitivity. J Occup Environ Med. 39(1):15-22, 1997.

An increasing number of people in Sweden are claiming that they are hypersensitive to electricity. These patients suffer from skin as well as neurological symptoms when they are near computer monitors, fluorescent tubes, or other electrical appliances. Provocation studies with electromagnetic fields emitted from these appliances have, with only one exception, all been negative, indicating that there are other factors in the office environment that can effect the autonomic and/or central nervous system, resulting in the symptoms reported. Flickering light is one such factor and was therefore chosen as the exposure parameter in this study. Ten patients complaining of electrical hypersensitivity and the same number of healthy voluntary control subjects were exposed to amplitude-modulated light. The sensitivity of the brain to this type of visual stimulation was tested by means of objective electrophysiological methods such as electroretinography and visual evoked potential. A higher amplitude of brain cortical responses at all frequencies of stimulation was found when comparing patients with the control subjects, whereas no differences in retinal responses were revealed.

Sandström M, Lyskov E, Hörnsten R, Hansson Mild K, Wiklund U, Rask P, Klucharev V, Stenberg B, Bjerle P. Holter ECG monitoring in patients with perceived electrical hypersensitivity. Int J Psychophysiol. 49(3):227-235, 2003.

Earlier studies have indicated that patients claiming to be sensitive to electromagnetic fields, so-called electrical hypersensitivity (EHS), have a dysbalance of the autonomic nervous system (ANS) regulation. This paper focuses on a possible dysbalance in the ANS among EHS patients by the use of long-term monitoring of electrocardiogram (ECG) in both a patient and a matched control group. At the same time, the environmental power frequency magnetic field was recorded for both groups in order to see if there was any difference in exposure between the groups. ECG, heart rate (HR) and heart rate variability (HRV) as well as the magnetic field exposure were monitored for 24 h. Fourteen patients with perceived EHS symptoms were selected from the University Hospital, Umeå, Sweden. Symptoms indicating autonomic nervous dysregulation were not part of the inclusion criteria of the patient group. Age and sex matched healthy subjects were used as controls. No differences were found between the groups regarding magnetic field exposure or the mean HR for 24 h. The HRV analyses showed that the high-frequency (HF) component did not have the expected increase with sleep onset and during nighttime in the EHS group. When separating the sleeping and awake time even less differences between the two conditions in the EHS patients, both for the low-frequency and HF components in the HRV spectrum, were seen. EHS patients had a disturbed pattern of circadian rhythms of HRV and showed a relatively 'flat' representation of hourly-recorded spectral power of the HF component of HRV.

Schreier N, Huss A, Rösli M. The prevalence of symptoms attributed to electromagnetic field exposure: a cross-sectional representative survey in Switzerland. Soz Präventivmed. 51(4):202-209, 2006.

OBJECTIVES: To investigate health risk perception as well as to assess the prevalence of self-reported symptoms attributed to electromagnetic fields (EMF) and other environmental exposures in the general population of Switzerland. **METHODS:** Between May and June 2004, telephone interviews of a representative sample of the Swiss population (n=2048, >14 years old) about: (1) health symptoms attributed to five environmental factors (one of which was

EMF), (2) health risk perception related to 12 environmental risk factors (five of which were different EMF sources). **RESULTS:** We found a prevalence of 5% (95% CI 4-6%) for electromagnetic hypersensitivity (EHS) in our study sample. The most common health complaints among EHS individuals were sleep disorders (43%) and headaches (34%), which were mostly attributed to power lines and mobile phone handsets. In addition, 53 percent (95% CI 51-55%) were worried about adverse health effects from EMF, without attributing their own health symptoms to them. **CONCLUSIONS:** The large proportion of the population who is concerned or attributes own symptoms to EMF may cause societal conflicts given the ubiquity of EMF in our everyday life.

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Schröttner J, Leitgeb N, Hillert L. Investigation of electric current perception thresholds of different EHS groups. Bioelectromagnetics. 28(3):208-213, 2007.

An increasing number of persons with health symptoms of unclear origin take refuge in the hypothesis that they suffer from electromagnetic hypersensitivity (EHS). So far EHS is not an accepted diagnosis and there is no validated test to verify the proposed relationship between electromagnetic fields and symptoms. Groups reporting EHS are very heterogeneous but share a belief that they have an increased sensitivity to electromagnetic fields. It was studied to which extent a quantitative indicator for electrosensitivity, the electric current perception threshold, and its variability coefficient, depend on the recruitment strategy for self-declared hypersensitive persons. Individual electrosensitivity was investigated by provocation of the lower arms to directly coupled 50 Hz electric currents. Self-declared EHS persons were selected from members of a self aid group, from responders to a newspaper call, and from persons actively asking for investigations in their search for help. It turned out that quantitative electrosensitivity was quite different among the three groups. It is interesting that the members of the EHS self aid group exhibit a considerable overlap with general population sample. Pooled together it could be shown that hypersensitive persons as a group differ significantly from the general population sample, however with a pronounced overlap with the normal range. It can be concluded that EHS groups are very inhomogeneous and contain numerous persons with no increased ability to perceive low frequency electric or magnetic fields. This investigation shows the importance of the study design, in particular of the recruitment strategies of EHS persons for the final outcome.

Schröttner J, Leitgeb N. Sensitivity to electricity--temporal changes in Austria. BMC Public Health. 8:310, 2008.

BACKGROUND: An increasing number of persons suffer from non-specific health symptoms such as headache, sleep disturbances, difficulties in concentrating and more. In lack of a medical explanation, more and more persons take refuge to the assumption that they were electromagnetic hypersensitive (EHS) and electromagnetic pollution causes their problems. The discussion whether electromagnetic fields (EMF) could cause such adverse health effects is still ongoing. **METHODS:** Based on the Austrian inhabitants a statistical cross-sample of the general population with regard to age, gender and federal state had been investigated to assess the actual situation and potential temporal changes in comparison with a former study of 1994. In a telephone survey a total number of 526 persons were included. **RESULTS:** This study showed an actual EHS prevalence of 3.5% compared with 2% estimated in 1994. About 70% of the sample believed that electromagnetic pollution could be a risk factor for health. More than 30% declared to at least some degree to be concerned about their well-being near mobile phone base stations or power lines. However, only 10% were actively looking for specific information. Media triggered EHS hypothesis in 24% of the cases. **CONCLUSION:** The results show that concerns about EMF did not decrease with time in spite of scientific studies and health risk assessments concluding that a causal relationship of EMF below recommended reference levels and non-specific health symptoms would be implausible.

Seitz H, Stinner D, Eikmann T, Herr C, Rösli M. Electromagnetic hypersensitivity (EHS) and subjective health complaints associated with electromagnetic fields of mobile phone communication--a literature review published between 2000 and 2004. Sci Total Environ. 349(1-3):45-55, 2005.

Literature published between 2000 to 2004 concerning electromagnetic fields (EMF) of mobile communication and electromagnetic hypersensitivity (EHS) or unspecific symptoms of ill health, respectively, is reviewed. Basically, literature from established databases was systematically searched for. For each study, the design and quality were evaluated by means of a criteria list in order to judge evidence for causality of exposures on effects. Finally, 13 studies of sufficient quality were considered for this review. In only one provocation study, individuals with self-reported electromagnetic hypersensitivity were exposed to EMF. Their perception of field status was no better than would have been expected by chance. Results of five randomised cross-over studies on impaired well-being due to mobile phone exposure were contradictory. Even though these studies would allow more reliable exposure assessment, they are limited due to short exposure period and the small study size. No firm conclusion could be drawn from a few observational epidemiological studies finding a positive association between exposure and unspecific symptoms of ill health due to methodological limitations. Causality of exposure and effect was not derivable from these cross-sectional studies as field status and health complaints were assessed at the same time. In addition, exposure assessment has not been validated. In conclusion, based on the limited studies available, there is no valid evidence for an association between impaired well-being and exposure to mobile phone radiation presently. However, the limited quantity and quality of research in this area do not allow to exclude long-term health effects definitely.

Silny J. Electrical hypersensitivity in humans--fact or fiction? Zentralbl Hyg Umweltmed. 202(2-4):219-233,1999.

The phenomenon of the so-called electrical hypersensitivity in the weak electromagnetic fields of everyday life, potentially causing different health symptoms, is reviewed under consideration of current results from in-vivo and in-vitro investigations as well as of statistical data. Electrical hypersensitivity cannot be explained by means of the known and validated influence mechanisms of electromagnetic fields in humans, as their thresholds are at least 50 times higher for harmless effects, and more than 1000 times higher for adverse effects than the strengths of the environmental fields. Present statistical data reveal clear inconsistencies in many respects. The prevalence varies by a factor 1000 although the reporting countries have comparable field and exposure situations. Neither the apparently random combination of symptoms on the side of the suffering patients nor the problematic attribution of the symptoms to certain electromagnetic field situations do support the hypothesis of a electrical hypersensitivity. On the other hand, the statistical data must be considered unsubstantiated because of the small number of cases and the procedures of survey. Consequently, there is a need for additional, systematic investigations of this group of patients under participation of different medical and biomedical disciplines.

Sobiczewska E, Szmigielski S. [Electromagnetic fields hypersensitivity]. Med Pr. 60(3):235-241, 2009. [Article in Polish]

The development of industry, particularly of new technologies in communication systems, gives rise to the number and diversity of electromagnetic field (EMF) sources in the environment. These sources, including power-frequent, radiofrequent and microwaves, make human life richer, safer and easier. But at the same time, there is growing concern about possible health risks connected with EMF exposure. An increasing number of persons have recently reported on a variety of health problems induced, in their opinion, by exposure to EMF. It is important to note that EMF levels to which these individuals are exposed are generally well below the recommended exposure limits and are certainly far below those known to produce any adverse effects. These persons call themselves "electromagnetic hypersensitivity individuals" And complain about experiencing various types of non-specific symptoms, including dermatological, neurological and vegetative. In the present paper, the problem of electromagnetic hypersensitivity phenomenon is discussed based on the recently published literature.

Swanbeck G, Bleeker T. Skin problems from visual display units. Provocation of skin symptoms under experimental conditions. Acta Derm Venereol. 69(1):46-51, 1989.

Thirty patients having skin problems experienced being caused by work with visual display units (VDU) were tested double-blind with two VDUs. One VDU had strong electrostatic and electromagnetic fields and the other VDU had an identical appearance but the electrostatic field and electromagnetic fields were practically eliminated. Approximately 80% of the patients reacted with stinging or itching in the face during the 3 hours working period with 25% relative humidity in the room. No difference between the VDUs was found with regard to provoking these symptoms. At 60% relative humidity 13 patients of 19 experienced stinging or itching in the face. Those 13 that reacted were asked to come another time and were informed that the VDU was not turned on and that all electric fields that were present came from the cable to the VDU. A green cloth was put over the VDUs. This time 11 of the 13 patients reacted with stinging and itching in spite of the fact that the VDU was turned off. The present study does not indicate that electric and electromagnetic fields are of major importance in provoking subjective skin symptoms in patients experiencing skin problems when working with VDUs.

Tseng MC, Lin YP, Hu FC, Cheng TJ. Risks Perception of Electromagnetic Fields in Taiwan: The Influence of Psychopathology and the Degree of Sensitivity to Electromagnetic Fields. Risk Anal. 2013 Mar 28. doi: 10.1111/risa.12041. [Epub ahead of print]

Little is known about the perceived health risks of electromagnetic fields (EMFs) and factors associated with risk perception in non-Western countries. Psychological conditions and risk perception have been postulated as factors that facilitate the attribution of health complaints to environmental factors. This study investigated people's perceived risks of EMFs and other environmental sources, as well as the relationships between risk perception, psychopathology, and the degree of self-reported sensitivity to EMFs. A total of 1,251 adults selected from a nationwide telephone interviewing system database responded to a telephone survey about the relationships between environmental sources and human health. The interview included questions assessing participants' psychiatric conditions and the presence and degree of sensitivity to EMFs. One hundred and seventy participants were self-identified as having sensitivity to EMFs, and 141 met the criteria for psychiatric conditions without EMF sensitivity. More than half of the survey respondents considered power lines and mobile phone base stations to affect people's health to a big extent. Higher sensitivity to EMFs, psychopathology, being female, being married, more years of education, and having a catastrophic illness had positive associations with perceived risks of EMF-related environmental sources as well as for all environmental sources combined. We observed no moderating effect of psychopathology on the association between degree of sensitivity to EMF and risk perception. Thus, psychopathology had influence on general people's risk perception without having influence on the relationship between people's degree of sensitivity to EMF and risk perception. The plausible explanations are discussed in the text.

Tuengler A, von Klitzing L. Hypothesis on how to measure electromagnetic hypersensitivity. Electromagn Biol Med. 32(3):281-290, 2013.

Electromagnetic hypersensitivity (EHS) is an ill-defined term to describe the fact that people who experience health symptoms in the vicinity of electromagnetic fields (EMFs) regard them as causal for their complaints. Up to now most scientists assume a psychological cause for the suffering of electromagnetic hypersensitive individuals. This paper addresses reasons why most provocation studies could not find any association between EMF exposure and EHS and presents a hypothesis on diagnosis and differentiation of this condition. Simultaneous recordings of heart rate variability, microcirculation and electric skin potentials are used for classification of EHS. Thus, it could be possible to distinguish "genuine" electromagnetic hypersensitive individuals from those who suffer from other conditions.

Wallace D, Eltiti S, Ridgewell A, Garner K, Russo R, Sepulveda F, Walker S, Quinlan T, Dudley S, Maung S, Deeble R, Fox E. Do TETRA (Airwave) base station signals have a short-term impact on health and well-being? A randomized double-blind provocation study. Environ Health Perspect. 118(6):735-741, 2012.

BACKGROUND: "Airwave" is the new communication system currently being rolled out across the United Kingdom for the police and emergency services, based on the Terrestrial Trunked Radio Telecommunications System (TETRA). Some police officers have complained about skin rashes, nausea, headaches, and depression as a consequence of using their Airwave handsets. In addition, a small subgroup in the population self-report being sensitive to electromagnetic fields (EMFs) in general. OBJECTIVES: We conducted a randomized double-blind provocation

study to establish whether short-term exposure to a TETRA base station signal has an impact on the health and well-being of individuals with self-reported "electrosensitivity" and of participants who served as controls. METHODS: Fifty-one individuals with self-reported electrosensitivity and 132 age- and sex-matched controls participated in an open provocation test; 48 sensitive and 132 control participants went on to complete double-blind tests in a fully screened semianechoic chamber. Heart rate, skin conductance, and blood pressure readings provided objective indices of short-term physiological response. Visual analog scales and symptom scales provided subjective indices of well-being. RESULTS: We found no differences on any measure between TETRA and sham (no signal) under double-blind conditions for either controls or electrosensitive participants, and neither group could detect the presence of a TETRA signal at rates greater than chance (50%). When conditions were not double blind, however, the self-reported electrosensitive individuals did report feeling worse and experienced more severe symptoms during TETRA compared with sham. CONCLUSIONS: Our findings suggest that the adverse symptoms experienced by electrosensitive individuals are due to the belief of harm from TETRA base stations rather than to the low-level EMF exposure itself.

Wallace D, Eltiti S, Ridgewell A, Garner K, Russo R, Sepulveda F, Walker S, Quinlan T, Dudley S, Maung S, Deeble R, Fox E. Cognitive and physiological responses in humans exposed to a TETRA base station signal in relation to perceived electromagnetic hypersensitivity. Bioelectromagnetics. 33(1):23-39, 2012.

Terrestrial Trunked Radio (TETRA) technology ("Airwave") has led to public concern because of its potential interference with electrical activity in the brain. The present study is the first to examine whether acute exposure to a TETRA base station signal has an impact on cognitive functioning and physiological responses. Participants were exposed to a 420 MHz TETRA signal at a power flux density of 10 mW/m² as well as sham (no signal) under double-blind conditions. Fifty-one people who reported a perceived sensitivity to electromagnetic fields as well as 132 controls participated in a double-blind provocation study. Forty-eight sensitive and 132 control participants completed all three sessions. Measures of short-term memory, working memory, and attention were administered while physiological responses (blood volume pulse, heart rate, skin conductance) were monitored. After applying exclusion criteria based on task performance for each aforementioned cognitive measure, data were analyzed for 36, 43, and 48 sensitive participants for these respective tasks and, likewise, 107, 125, and 129 controls. We observed no differences in cognitive performance between sham and TETRA exposure in either group; physiological response also did not differ between the exposure conditions. These findings are similar to previous double-blind studies with other mobile phone signals (900-2100 MHz), which could not establish any clear evidence that mobile phone signals affect health or cognitive function.

Wang J, Su H1, Xie W, Yu S. Mobile Phone Use and The Risk of Headache: A Systematic Review and Meta-analysis of Cross-sectional Studies. Sci Rep. 2017 Oct 3;7(1):12595. doi: 10.1038/s41598-017-12802-9.

Headache is increasingly being reported as a detrimental effect of mobile phone (MP) use. However, studies aimed to investigate the association between MP use and headache yielded conflicting results. To assess the consistency of the data on the topic, we performed a systematic review and meta-analysis of the available cross-sectional studies. Published literature from PubMed and other databases were retrieved and screened, and 7 cross-sectional studies were finally included in this meta-analysis. The pooled odds ratio (OR) and 95% confidence interval (CI) were calculated. We found that the risk of headache was increased by 38% in MP user compared with non-MP user (OR, 1.38; 95% CI, 1.18-1.61, $p < 0.001$). Among

MP users, the risk of headache was also increased in those who had longer daily call duration (2-15 min vs. <2 min: OR, 1.62; 95% CI, 1.34-1.98, $p < 0.001$; >15 min vs. <2 min: OR, 2.50; 95% CI, 1.76-3.54, $p < 0.001$) and higher daily call frequency (2-4 calls vs. <2 calls: OR, 1.37; 95% CI, 1.07-1.76, $p < 0.001$; >4 calls vs. <2 calls: OR, 2.52; 95% CI, 1.78-3.58, $p < 0.001$). Our data indicate that MP use is significantly associated with headache, further epidemiologic and experimental studies are required to affirm and understand this association.

Wilén J, Sandström M, Hansson Mild K. Subjective symptoms among mobile phone users--a consequence of absorption of radiofrequency fields? Bioelectromagnetics. 24(3):152-159, 2003.

In a previous epidemiological study, where we studied the prevalence of subjective symptoms among mobile phone (MP) users, we found as an interesting side finding that the prevalence of many of the subjective symptoms increased with increasing calling time and number of calls per day. In this extrapolative study, we have selected 2402 people from the epidemiological study who used any of the four most common GSM MP. We used the information about the prevalence of symptoms, calling time per day, and number of calls per day and combined it with measurements of the Specific Absorption Rate (SAR). We defined three volumes in the head and measured the maximum SAR averaged over a cube of 1 g tissue (SAR(1g)) in each volume. Two new exposure parameters Specific Absorption per Day (SAD) and Specific Absorption per Call (SAC) have been devised and are obtained as combinations of SAR, calling time per day, and number of calls per day, respectively. The results indicates that SAR values >0.5 W/kg may be an important factor for the prevalence of some of the symptoms, especially in combination with long calling times per day.

Wilen J, Johansson A, Kalezic N, Lyskov E, Sandstrom M. Psychophysiological tests and provocation of subjects with mobile phone related symptoms. Bioelectromagnetics. 27(3):204-214, 2006.

The aim of the present study was to investigate the effect of exposure to a mobile phone-like radiofrequency (RF) electromagnetic field on persons experiencing subjective symptoms when using mobile phones (MP). Twenty subjects with MP-related symptoms were recruited and matched with 20 controls without MP-related symptoms. Each subject participated in two experimental sessions, one with true exposure and one with sham exposure, in random order. In the true exposure condition, the test subjects were exposed for 30 min to an RF field generating a maximum SAR(1g) in the head of 1 W/kg through an indoor base station antenna attached to a 900 MHz GSM MP. The following physiological and cognitive parameters were measured during the experiment: heart rate and heart rate variability (HRV), respiration, local blood flow, electrodermal activity, critical flicker fusion threshold (CFFT), short-term memory, and reaction time. No significant differences related to RF exposure conditions were detected. Also no differences in baseline data were found between subject groups, except for the reaction time, which was significantly longer among the cases than among the controls the first time the test was performed. This difference disappeared when the test was repeated. However, the cases differed significantly from the controls with respect to HRV as measured in the frequency domain. The cases displayed a shift in low/high frequency ratio towards a sympathetic dominance in the autonomous nervous system during the CFFT and memory tests, regardless of exposure condition. This might be interpreted as a sign of differences in the autonomous nervous system regulation between persons with MP related subjective symptoms and persons with no such symptoms.

Wilén J, Wiklund U, Hörnsten R, Sandström M. Changes in heart rate variability among RF plastic sealer operators. Bioelectromagnetics. 28(1):76-79, 2007.

In a previous study, we showed that operators of radiofrequency (RF) plastic sealers, RF operators (n = 35) had a lower heart rate during nighttime compared to a control group (n = 37). We have analyzed the heart rate variability (HRV) on the same group of people to better understand the possible underlying rhythm disturbances. We found a significantly increased total HRV and very low frequency (VLF) power during nighttime among the RF operators compared to a control group. Together with our previous finding of a significantly lower heart rate during nighttime among the RF operators compared to the controls, this finding indicates a relative increase in parasympathetic cardiac modulation in RF operators. This could in turn be due to an adaptation of the thermoregulatory system and the cardiac autonomic modulation to a long-term low-level thermal exposure in the RF operators.

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Radiation Sickness; Could Myelin Damage from Radiofrequency Electromagnetic Field Exposure Help Explain the Functional Impairment Electrohypersensitivity? A Review of the Evidence. Journal of Toxicology and Environmental Health. (Redmayne and Johansson); 2014

COULD MYELIN DAMAGE FROM RADIOFREQUENCY ELECTROMAGNETIC FIELD EXPOSURE HELP EXPLAIN THE FUNCTIONAL IMPAIRMENT ELECTROHYPERSENSITIVITY? A REVIEW OF THE EVIDENCE

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Myelin provides the electrical insulation for the central and peripheral nervous system and develops rapidly in the first years of life, but continues into mid-life or later. Myelin integrity is vital to healthy nervous system development and functioning. This review outlines the development of myelin through life, and then considers the evidence for an association between myelin integrity and exposure to low-intensity radiofrequency electromagnetic fields (RF-EMFs) typical in the modern world. In RF-EMF peer-reviewed literature examining relevant impacts such as myelin sheath, multiple sclerosis, and other myelin-related diseases, cellular examination was included. There are surprisingly little data available in each area, but considered together a picture begins to emerge in RF-EMF-exposed cases: (1) significant morphological lesions in the myelin sheath of rats; (2) a greater risk of multiple sclerosis in a study subgroup; (3) effects in proteins related to myelin production; and (4) physical symptoms in individuals with functional impairment electrohypersensitivity, many of which are the same as if myelin were affected by RF-EMF exposure, giving rise to symptoms of demyelination. In the latter, there are exceptions; headache is common only in electrohypersensitivity, while ataxia is typical of demyelination but infrequently found in the former group. Overall, evidence from in vivo and in vitro and epidemiological studies suggests an association between RF-EMF exposure and either myelin deterioration or a direct impact on neuronal conduction, which may account for many electrohypersensitivity symptoms. The most vulnerable are likely to be those in utero through to at least mid-teen years, as well as ill and elderly individuals.

A recent report by the Health Council of the Netherlands highlighted the importance of myelination because of its role in providing electrical insulation to the nerve fibers (Health Council of the Netherlands, 2011). The council raised an important question: Can exposure to external electromagnetic fields, which create an electrical field in the brain, affect natural development and pruning of synapses during human development? This conservative advisory body stated that it is of “great

importance to gather more information on this” (20). The council refers to both radiofrequency and extremely low-frequency electromagnetic field (RF-EMF and ELF-EMF) exposures at intensities too low to produce thermal damage. These are omnipresent, both environmentally (such as from mobile phone base stations and WiFi routers) and individually (such as from mobile phones, tablets, laptops, and iPods). The council’s question is relevant and particularly important in the unborn and very young. The

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brain develops rapidly in utero, and at critical stages of development from infancy through adolescence and early adulthood, when axons and dendrites undergo pruning and synapses are formed. The process occurs under the influence of the brain's internally generated electrical activity in concert with an intricate chemical crosstalk using growth and differentiating factors as well as modulators and co-modulators (Fuxe et al., 1986).

Individuals claiming to suffer from exposure to electromagnetic fields (EMF) have been reported. In Sweden, electrohypersensitivity (EHS) is an officially fully recognized functional impairment (i.e., it is not regarded as a disease). Those who are electrosensitive commonly indicate having particular sources of exposures to which they are sensitive, which vary among those with the condition (Röösli et al., 2004). A rudimentary analysis comparing reported symptoms of those having EHS with those in a Swiss Health Survey showed significantly increased incidence of sleep disorders and severe headaches, and a reduced incidence of asthma in those with EHS (Röösli et al., 2004). With repeated exposures, response time reduces and reaction tends to grow more severe than when symptoms from the same source were first experienced, unless there has been an unexposed period of months, after which recurrence of symptoms may take a day or more (personal communication, Rob Hutchins, spokesperson for ElectroSensitivity New Zealand, April 2014).

Different sources may elicit different responses in any one person. Röösli et al. (2004) noted a trend toward more headaches in those using (cathode ray) display terminals, concentration problems and tinnitus with use of communication devices (RF), and nervousness or distress from ELF exposures. This is in agreement with the findings of Gordon et al. (1963), who suggested that "with low-intensity irradiations [1 mW/cm²], the degree and sometimes even the nature of the functional and morphological changes depended on the wavelength." It may also explain why double-blind exposure studies with electrohypersensitives and a control group have not generally or consistently found a significant

relationship (Rubin et al., 2005), as responses appear not to be uniform (Havas, 2013) and depend upon the stage of EHS and the time since the last exposure.

In Sweden, the prevalence of EHS was first estimated at 1.5% of the population in a survey undertaken in 1997 (Hillert et al., 2002), and a newer estimate is 2.6–3.2% (Johansson, 2006). In Austria the prevalence was estimated to be less than 2% in 1994 but rose to 3.5% in 2001 (Schrottner and Leitgeb, 2008). In California, the prevalence of self-reported sensitivity to electromagnetic fields was 3.2%, with 24.4% of those surveyed also reporting sensitivity to chemicals (Levallois et al., 2002). In Switzerland, 5% of the population was estimated to suffer from EHS in a survey undertaken in 2004 (Schreier et al., 2006). Finally, the Canadian Human Rights Commission noted that approximately 3% of Canadians have been diagnosed with environmental sensitivities, including to chemicals and EMF in their environment (Sears, 2007). In the report, Sears (2007) recommended improving the environmental quality at workplaces.

In yet unpublished studies by Johansson et al. (personal communication), the epidermal nerve fibers of electrohypersensitive persons were markedly reduced in length and number of nerve terminals, indicating apparent damage. The question is whether this occurred due to myelin sheath destruction or functional axonal conduction disruption. In neuroscience it is a well-established fact that reduction of the number of nerve fibers and concomitantly axonal terminals leads to an elevation in sensitivity, the so-called supersensitivity phenomenon (Gerfen, 2003). Can these also be underlying mechanisms for electrohypersensitivity?

This review focuses on effects attributed to RF-EMF. Extremely low-frequency (ELF) effects are also important to explore with relation to myelin, as there have been studies conducted regarding the use of ELF for therapeutic purposes (Sherafat et al., 2012; Baptista et al., 2009; Protasoni et al., 2009; Aydin et al., 2006; Mert et al., 2006). Perhaps the most important observation regarding these is that they present vital evidence that biological effects are

frequency dependent: that is, responses may be positive, neutral, or negative, depending upon the frequency of the exposure. However, the associations of ELF and myelin integrity were not examined.

It is also pertinent to ask whether nonmyelinated nerves are more susceptible to direct interference from RF EMF, but this also lies outside the scope of this article. Briefly, there are studies that demonstrated redistribution of transmembrane sodium channels after exposure to pulsed RF EMF (Schneider and Pekker, 2013), and changes in neuronal firing rate and plasma membrane properties after extremely low, brief exposures of neonatal rat cerebral cortical tissue (Pikov et al., 2010).

In this review, we examined whether there may be a connection between symptoms reported after exposure to RF-EMF (chronic and acute nonthermal exposures) and compromised myelin integrity. Is there any evidence to suggest it, and is the hypothesis reasonable? These are important questions because loss of myelin is critical in several diseases, including multiple sclerosis (MS).

The aim of this review is to outline what myelin is and its normal course of development over the life span. Animal studies examining effects of RF-EMF on myelin sheathing and epidemiological research examining multiple sclerosis with relation to RF-EMF exposure are presented.

METHODOLOGY

Published information was collected on myelin and myelin damage, related diseases such as multiple sclerosis, relevant cellular changes, and the functional impairment electrohypersensitivity, by using conventional scientific literature databases, such as biomedical literature from PubMed, Medline, life science journals, EMF-Portal, and online books, available on the Internet.

MYELIN AND ITS DEVELOPMENT

Myelin is a fatty membrane that provides insulation that enables rapid propagation of

electrical impulses along nerves. Myelin is produced by two types of glial cell, oligodendrocytes and Schwann cells, and is primarily composed of water, lipids, and protein. Within the myelin, there are interlinked hydrocarbon chains of sphingomyelin, which provides a strengthening framework (Mandal, 2014). Sphingolipids also play important roles in signal transduction (Healy, 2008). Disorders in sphingomyelin result in lack of sphingomyelin phosphodiesterase (SMase). SMase is a hydrolase enzyme whose role is to degrade sphingolmyelin in phosphocholine and ceramide. This prevents buildup of sphingomyelin in the brain, bone marrow, and liver, which would otherwise result in impaired motor skills, muscle strength, vision and hearing problems, and ultimately death (Healy, 2008).

Myelin develops spirally around neuronal axons, creating a sheath that increases in effectiveness as it thickens. Oligodendrocyte cells are found only in the central nervous system (CNS), and each cell myelinates the axons of several neurons, while Schwann cells are responsible for myelinating the peripheral nervous system (PNS), there being one cell for each axon (Bear et al., 2007). There are small gaps in the myelin sheath at the axon hillock and at locations called the nodes of Ranvier. At these points, ions cross the axon to create action potential, thus boosting the signal along the axon.

If myelin is damaged, the impulses traveling along the nerves slow down. Apart from crush injuries, initiation and mechanism for myelin damage are not understood but are considered to be related to environmental or genetic factors. If myelin is not repaired, this results in a variety of symptoms and diseases. The most common of these is the autoimmune condition multiple sclerosis, which affects the CNS (Table 1). Conditions that affect the PNS include Guillain-Barré syndrome and chronic inflammatory demyelinating polyradiculoneuropathy (CIDP). CIDP is thought to be an autoimmune condition and is generally characterized by fatigue and increasing weakness, tingling, and pain in the limbs, beginning at the toes and fingers (National Institute of Neurological

TABLE 1. Symptoms Reported by People After Exposure (or Presumed Exposure) to RF-EMFs With Symptoms of Demyelination

	Symptoms of electrohypersensitivity	Symptoms of demyelination
Vision	Difficulty in seeing, smarting, pain	Blurred vision Progressive vision loss/blurring (children), pain, light flashes (children)
Motor	Trunk/limb/joints aches, pain Numbness Weakness	Trunk/limb weakness Numbness Weakness and fatigue Balance problems
Sensory	Tickling, prickling, burning sensations (ie numbness, paraesthesia)	Numbness, paresthesia (i.e., tickling, prickling, burning sensations)
Cerebellar	Tremor Faintness Dizziness Sleep problems Headaches Abnormally tired/sleep problems	Tremor Ataxia (reduced muscle control, incoordination) Seizures (children) Balance problems (children) Lethargy (children)
Cognitive/neuropsychiatric/ emotional	Short and long term memory impairment Lack of concentration Difficulty learning new things Irritability Anxiety Stress (feeling of lack of control) Mood changes (including anger) Depression	Memory impairment Concentration impairment Irritability Anxiety Confusion (children)

Note. Sources: ESUK (2014); Mar (2014); National Multiple Sclerosis Society (2014).

Disorders and Stroke, 2014). It is most common in young men.

Humans are born with scant electrical insulation of their nervous system. During development, a sheath of fatty myelin begins developing, first around axons in the CNS, then also sheathing peripheral and increasingly thinner axons (Wheeler, 2009). Once developed, it acts as electrical insulation and prevents the electrical signaling along the neuron from leaking out through the walls of the neuron. Its purpose is to enable efficient, speedy conduction of electrical nerve impulses. The major development of CNS sheathing occurs during the fourth and fifth months of gestation, continuing from the wk 25 of gestation until the age of 2 yr (Rathus, 2010), but age-related changes to axon thickness and white matter density visible in magnetic resonance imaging (MRI) scans indicate that it continues throughout childhood and adolescence (Paus et al., 1999). Myelination begins in the brainstem and cerebellar regions, progressing through to

the frontal lobes during adolescence (Yakovlev and Lecours, 1967), and thereafter repeating in cycles. Wheeler (2009) suggested that myelination development, repair, and replacement continue throughout the CNS and PNS until late middle age, coating smaller and smaller diameter axons in increasingly thinner layers. The myelination of the splenium (located at the posterior end of the corpus callosum) is central to the efficiency of interhemispheric synchronization; this occurs over a protracted period (Knyazeva, 2013). Bartzokis (2011) proposed a theory that optimal brain function relies on finely tuned action potential synchronization, which myelin enables, but that in the presence of oxidative and environmental abnormalities and stressors, epigenetic changes result, leading to developmental and degenerative diseases. Being fatty, myelin does not contain free ions. Keshvari et al. (2006) postulated that this indicates that as the myelin sheath develops there is also a reduction in electrical conductivity of brain tissue. The reverse side of this coin is

that there is a higher overall electrical conductivity in the fetus, infant, and young child brain, as well as in those whose myelin has begun degenerating. Myelin deposition is delayed in malnourished children (Rodier, 2004), thereby possibly leaving some of lower socioeconomic status more vulnerable.

Excessive production of synaptic connections during fetal development is followed by heavy perinatal pruning; a second round, in the prefrontal cortex, occurs later with a marked rise in synapses at the onset of puberty (Huttenlocher, 1979), followed by pruning and reorganization during adolescence (Blakemore and Choudhury, 2006). This process is not complete until early adulthood. Rodier (2004) suggested that because prenatal CNS and myelination developmental processes are highly vulnerable to damage by environmental agents, it is reasonable to expect that brain development during childhood and adolescence also faces particular risks.

RF-EMF RESEARCH

The most relevant studies available were undertaken in the 1970s. In considering chronic effects, Switzer and Mitchell (1977) exposed 6-wk-old rats (5 h/d, 5 d/wk for 22 wk) to continuous-wave 2450-MHz RF-EMR (SAR 2.3 W/kg). There was a gap of 6 wk after exposure before analysis. Analysis using an electron microscope indicated a significant elevation in the number of myelin figures protruding into the cortical dendrites of the radiated, compared to control, subjects. No other striking structural changes were apparent. Baranski (1972) exposed guinea pigs and rabbits. Different guinea pig groups had exposures of 3.5 mW/cm² or 25 mW/cm², each being either continuous or pulse modulated. Exposure was at 3000 MHz, for 3 h daily for 3 mo, or the same frequency for a single 3-h session. The rabbits experienced 3 mo of chronic exposure at 5 mW/cm². Resulting damage was the same with both types of irradiation, but lesions were more marked and extensive from pulsed transmissions. Baranski (1972)

found spherical metachromatic bodies in the myelin with large spheres in nervous tracts and glial cells, and smaller ones near the third ventricle and reticular formation structures, particularly around blood vessels within the myelin. These spheres were attributed to metabolic disturbances in the myelin sheath and particularly in the oligodendrocytes. Demyelination was indicated by a Marchi's reaction test. Some hyperchromatic cell bodies in the white matter had spirally twisted neurites typical of "chronic Nissl's disease." It should be noted that exposure at 25 mW/cm² produced thermal damage, and that 3.5 mW/cm² exceeds the public exposure reference levels, although falling within occupational exposures. Further, 2.3 W/kg is higher than permitted under International Commission on Non-Ionizing Radiation Protection (ICNIRP) or Institute of Electrical and Electronics Engineers (IEEE) standards. However, no temperature increases were evident at 3.5 mW/cm² or 2.3 W/kg. The greater impact of pulse-modulated exposures reported by Baranski (1972) is of great importance, since all present-day digital microwave radiation types are pulsed. This occurrence is explained by the ion forced-vibration theory (Panagopoulos et al., 2002), supported theoretically more recently by Halgamuge and Abeyranthe (2011).

OTHER RESEARCH RELEVANT TO MYELIN LOSS AND RELATED SYMPTOMS

A national Danish cohort study compared the country's MS register against private mobile phone subscription holders and nonholders prior to 1996 (Poulson et al., 2012). Despite the most basic estimate of exposure (phone ownership or not), there was one subgroup of account holders with significant elevated incidence, namely, women with >10 yr of mobile phone subscription (RR 2.08, 95%CI: 1.08–4.01; *n* = 9). A few MS onset symptoms were also significantly related, although different for men and women. Women had an increased incidence of fatigue (RR 3.02, CI: 3.02–6.28),

while men experienced an elevated frequency of optic neuritis (RR 1.38 CI: 1.03–1.86). Diplopia (blurred vision) was not significant in either group separately, but together the incidence risk rate was 1.38 (CI: 1.02–1.86). Finally, there was an elevated risk of death in MS patients with subscriptions 7–9 yr after MS diagnosis compared to those without subscriptions (RR, 2.44; 95% CI: 1.20–4.98; $n = 8$); however, it should be noted that the number in this category was small. The study excluded corporate subscriptions, which are likely to have been the highest users at that time. Since these are also likely to have been predominantly accounts for use by men, this may explain the significant MS results being in a subgroup of women.

Schüz et al. (2007) investigated a possible link between cellular telephone use and risks for various CNS diseases. In their large nationwide cohort study of 420,095 persons in Denmark, no marked associations for amyotrophic lateral sclerosis, multiple sclerosis, or epilepsy (in women) were observed, but there was an excess of migraine and vertigo connected to the mobile phone use. Elsewhere, rats were exposed to both 1.5 W/kg and 6 W/kg (GSM [global system for mobile communications] pulsed modulation) (Anane et al., 2003). There was a significant rise in amplitude of induced experimental allergic encephalomyelitis crisis between sham and real exposure at 1.5 W/kg (which is a permitted exposure in the ICNIRP and IEEE guidelines) but not at 6 W/kg, despite no marked difference in onset, duration, or termination. This condition is an inflammatory demyelinating disease of the CNS. The abstract does not mention this increase.

A small study published in 2007 found no gross effects on measured human cortical parameters in either healthy participants ($n = 10$) or MS participants ($n = 2$) (Inomata-Terada et al. 2007). Subjects were exposed to an 800-MHz pulsed signal for 30 min at the maximum permitted power output, using an adapted hand-held phone. For those with MS, exposure was before and after a hot bath, which generally brought on MS-related

weakness. These data were unable to be analyzed statistically and were assessed individually by observation.

Symptoms of myelin loss include numbness and paraesthesia. An explanation is that alterations of myelin as well as Schwann cells of the sensory nerves may lead to functional alterations, slowing down of nerve signal conductance, and changes of nerve terminal sensitivity, which would lead to sensations of numbness and paresthesia, with the latter forming conscious thoughts via the spinal cord, thalamus, and primary as well as associative sensory brain cortex.

The skin is the organ most exposed to RF-EMF. Effects of EMF exposure on the skin were published in the 1960s. In experiments with rats, low-intensity exposure (≤ 1 mW/cm²) reduced nucleoprotein content of various cells and tissues. Thereafter, marked morphological changes were observed in the receptor and interoceptor apparatuses for skin after exposures of 1 mW/cm², with slight changes noted elsewhere, including intestinal wall, the wall of the bladder, and aorta (Gordon et al., 1963). This study also found slight morphological changes in the axon-soma and axon-dendrite interneuron connections of the cerebral cortex. These effects were reversible, disappearing after 3 to 4 wk. Some reactions were only seen with frequencies below 3GHz, suggesting that the degree of functional and morphological changes depended on the wavelength.

There are also studies indicating involvement of cells or proteins related to production of myelin. Peinnequin et al. (2000) found that 2.45-GHz nonthermal exposure of Jurkat T cells over 48 h initiated Fas-induced apoptosis. When considered with other results, there was the potential that exposure affected either membrane proteins through the Fas receptor or SMase activation, or the Fas pathway between receptor and caspase-3 activation. In a study exposing human bone-marrow mesenchymal stem cells to a 1-mT 50-Hz field for 12 d, oligodendrocyte protein O4 was induced (Cho et al., 2012). Data indicated that in toto ELF might induce neural differentiation in these

cells. Hardell et al. (2010) determined the risk of oligodendroglioma and mobile or cordless phone exposure in deceased cases from certain areas of Sweden who were diagnosed with this tumor between 1997 and 2003. Results revealed a high odds ratio (OR) for those with >10 yr of phone use (OR = 10, 95% confidence interval [CI] = 1.1–89), but this was based on only 2 cases in this category, out of 9 who died from this tumor.

The presence of intraepidermal nerve fibers was investigated in normal human skin from healthy volunteers using the new marker PGP 9.5 (Wang et al., 1990). The intraepidermal nerve fibers are found as close as 20–40 μm from the surface, which makes it highly possible that weak EMF may affect them. In facial skin samples of electrohypersensitive persons, the most common finding was a marked rise of mast cells (Johansson and Liu, 1995). From these studies, it is clear that the number of mast cells in the upper dermis is increased in the EHS group. A different pattern of mast cell distribution also occurred in the EHS group, namely, the normally empty zone between the dermo-epidermal junction and mid- to-upper dermis disappeared in the EHS group and, instead, this zone had a high density of mast-cell infiltration. These cells also seemed to have a tendency to migrate toward the epidermis (= epidermotrophism), and many of them emptied their granular content (= degranulation) in the dermal papillary layer. Further, more degranulated mast cells could be seen in the dermal reticular layer in the EHS group, especially in those cases that had the mast-cell epidermotrophism phenomenon just described. Finally, in the EHS group, the cytoplasmic granules were more densely distributed and more strongly stained than control, and generally, the size of the infiltrating mast cells was noted to be larger in the EHS group. It is noteworthy that increases of a similar nature were demonstrated at a later experimental study employing normal healthy volunteers in front of cathode ray tube (CRT) monitors, including ordinary household television sets (Johansson et al., 2001).

A COMPARISON OF SYMPTOMS OF ELECTROHYPERSENSITIVITY AND DEMYELINATION

If myelin sheathing were compromised by repeated or chronic exposures to RF-EMF, one might expect to see an elevation in typical symptoms of demyelination. Specific symptoms depend upon the particular disease, which are diverse and include blurred vision, trunk/limb weakness, numbness, paresthesia, tremor or reduced coordination, memory impairment, reduced concentration or processing speed, depression, irritability, and anxiety (National Multiple Sclerosis Society, 2014). MS is unusual in children; however, symptoms they encounter include confusion, alteration of consciousness, lethargy, and visual symptoms including pain and flashes of light (Mar, 2014).

These symptoms have also been described as symptoms of EHS, although generally in lay language such as tickling/prickling sensations as opposed to paresthesia (Table 1).

Onset of any of these symptoms in these circumstances has come to be called electrohypersensitivity, although any one person may have a different set of symptoms from another. It should be noted that in a systematic review of both short-term exposure and epidemiological studies to investigate such claims, the overall evidence to support them was thin (17 out of 117 potentially eligible papers were included after checking the qualifying criteria set by the research group) (Röösli et al., 2010). Johansson (2006, pp. 245–246) recorded early symptoms of electrohypersensitivity as “itch, smarting, pain, heat sensation, redness, papules, pustules . . . [and] frequently [symptoms related to] internal organ systems, such as the heart and the central nervous system, are also encountered.” According to Sweden’s National Board of Health and Welfare, the most commonly reported symptoms of electrohypersensitivity are fatigue, difficulty in concentrating, dizziness, nausea, palpitations and digestive disturbances (Socialstyrelsen (The National Board of Health and Welfare) 2014).

The British organization ElectroSensitivity United Kingdom (ESUK) describes symptoms

such as those itemized in the left column of [Table 1](#) (ESUK, 2014). There have been reports of cardiovascular problems such as tachycardia and arrhythmia, although these are relatively rare. Havas (2013) demonstrated these symptoms in double-blind, sham-controlled circumstances.

DISCUSSION

Despite early indications of damage to myelin sheathing in animals exposed to RF-EMF in the 1970s, there has been remarkably little research follow-up. There is still a lack of basic experimental evidence for a clear association between myelin damage and electrohypersensitivity, but given the preceding hypothesis it would be of great interest to investigate this in more detail using classical immunohistochemical markers for healthy and degenerated myelin, respectively, and for Schwann cells in general. Since myelin is the main electrical insulation that ensures efficient electrical functioning of the CNS, its integrity is vital to this, and healthy development of the neuronal system may also be. Therefore, it is important to know whether or not it is damaged by exogenous RF-EMF exposures.

What evidence is there that it may be? There do not appear to be national registers for MS, but the UK Multiple Sclerosis Trust reports that prevalence in women is increasing (Multiple Sclerosis Trust 2014). Race and latitude have been identified as influential in risk, but that incidence may be modified by the environment (Rosati 2001). When a child uses a wireless phone against the head (held at the usual angle), the most exposed area in that child's brain is the cerebellum (Christ et al. 2010); this is one of the first areas myelinated. As the head size nears adulthood, and depending upon head geometry, the most exposed area becomes the temporal lobes. This suggests that during adolescence the temporal lobes may be more susceptible to RF-EMF interference, not only because this region is not yet fully myelinated at that age, but because of enhanced vulnerability during active synaptic

rearrangement and pruning in progress at that age.

Demyelination and electrohypersensitivity have many symptoms in common. This latter condition is frequently regarded as psychosomatic, with the symptoms being claimed to be subjective, nonspecific, and hard to test objectively. However, these symptoms clearly point to a common, highly specific, biological and behavioral avoidance reaction and most can easily be objectively studied and quantified. For instance, the subjective sensations of tingling in the skin, itching, and heat may all be explained by changes in biochemical markers, especially histamine of the mast cells, observed by Johansson (2006).

A review of provocation studies of electrohypersensitives investigations generally did not show a significant response compared with control groups (van Rongen et al., 2009); however, it was acknowledged that such studies are often disadvantaged by short exposure durations.

The symptoms of the two conditions, demyelination and electrohypersensitivity, are not entirely matched. Reduced muscle control (ataxia) is an important symptom of demyelination, as are seizures and balance problems in children, but infrequently reported as a symptom of RF-EMF exposure, although the more minor cerebellar conditions of tremors and dizziness are. On the other hand, there are a few symptoms such as headache, tinnitus, heart arrhythmia, and skin problems that are commonly reported from RF-EMF exposure but are not symptoms of demyelination.

An increased heart rate, altered heart-rate variation, and changes in the sympathetic and parasympathetic control of the autonomic nervous system have been objectively tested and demonstrated as associated with RF-EMR exposure in more than one study (Havas and Marrongelle 2013). Headaches have been associated with exposure in several epidemiological studies. In a review by Augner et al. (2012), there were in total 737 participants in 8 studies who evaluated headaches with relation to RF-EMF exposure and demonstrated an overall marginal association of headaches

with RF-EMFs. Such a link was also found by Redmayne et al. (2013). It is possible that these or other non-myelin-related conditions are a result of stress due to worry regarding exposures. It is also possible that there is another as yet unidentified mechanism responsible.

It is risky to identify a cause by linking it backwards to symptoms such as discussed in this review because these symptoms are also intrinsic to other diseases. Therefore, this review began by asking, is there any evidence to support the hypothesis that RF-EMF exposure symptoms are related to demyelination, and is the hypothesis reasonable? It appears that the hypothesis is reasonable and that the evidence from in vivo, in vitro, and epidemiological studies is sufficiently strong to warrant urging that RF-EMF exposure from prebirth through to at least mid teens should be minimized until this issue is clarified. Overall, evidence suggests an association between RF-EMF exposure and either myelin deterioration or a direct impact on neuronal conduction, which may account for many electrohypersensitivity symptoms.

If myelin integrity is compromised by RF-EMF exposure, the greatest impact for humans would most likely be at each end of the life span. The CNS of the fetus, infant, child, and adolescent, whose myelination is incomplete, especially peripherally, and whose neural connections are rapidly forming and being pruned may be most susceptible, as may that of older people whose myelin protection is already degenerating, notably those with MS or other diseases in which loss of myelin is instrumental. It is not clear whether myelin deterioration from repeated RF exposure may initiate MS or whether it might exacerbate an existing condition. It may also be that before myelin sheath has developed or after it has begun deteriorating, functional axonal conduction may be disrupted directly, but this needs exploring. The similarities of demyelination and electrohypersensitivity cannot be taken as any proof of cause and effect, but it is believed they, and other evidence provided here, highlight the necessity for research in this area. Knowing whether myelin integrity or the natural development and pruning of synapses during

human development are affected by RF-EMF is of great importance because of the serious consequences it implies for personal and public health if that is the case.

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Radiation Sickness; No Safe Place - shattered lives, healthcare set to crash – you can't fix this fast enough; Letter to a Mayor, Olga Sheean, Jun. 15, 2016

NO SAFE PLACE

shattered lives, healthcare set to crash – you can't fix this fast enough



A letter to Mayor Gregor Robertson
by Olga Sheean

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Also sent to:

- Prime Minister Justin Trudeau
- David Eby, MLA
- Hedi Fry, MP
- Elizabeth May, MP
- Joyce Murray, MP
- The David Suzuki Foundation
- Dr Erica Mallery-Blythe, PHIRE/Radiation Research Trust
- Dr Dietrich Klinghardt, the Klinghardt Academy
- Elizabeth Kelley, Director, EMFscientist.org
- Dr Joel Moskowitz, Electromagnetic Radiation Safety, saferemr.com
- *The Vancouver Sun*
- *Metro News*
- *The Globe and Mail*
- *The Tyee*

15 June 2016

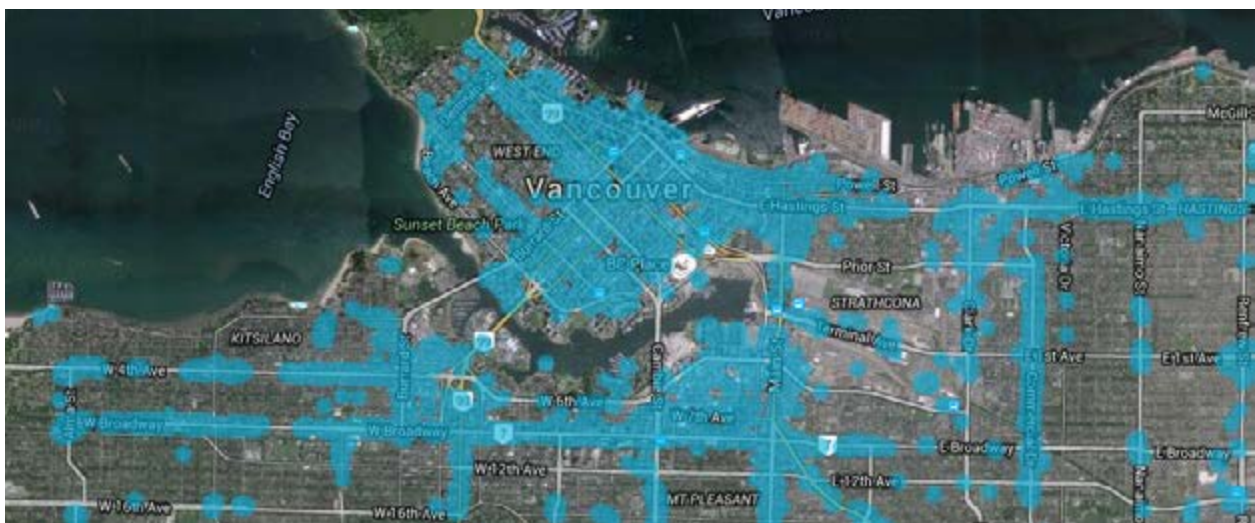
Dear Mr Robertson,

In 2003, when I worked for the World Health Organization (WHO) in Geneva, the Director General Dr Gro Harlem Brundtland resigned because cell phone radiation was making her ill. Along with countless other doctors, researchers and scientists, Brundtland has stated that “research shows deleterious effects” from the use of cell phones and other devices emitting radiation. “This is not an innocent technology,”¹ she says. It’s an inconvenient truth that we ignore because we’re so far down the rabbit hole of wireless living.

Your campaign to bombard the city with harmful radiation (benignly referred to as Wi-Fi) clearly demonstrates that you are uninformed about the scientifically proven harmful effects of non-ionizing/non-thermal Wi-Fi and other electromagnetic radiation (EMR). It also shows that, as an elected public servant, you have failed to do your own due diligence. In promoting free Wi-Fi as a positive enhancement to the community, you have led people to believe that there is no danger involved and that they can use their various electronic gadgets to their hearts’ content—with no regard for others (babies, children, transit passengers, neighbours etc) affected by them doing so.

Ignored, excluded and incapacitated: citizens forced to flee

Because of this, I’m being forced to leave Vancouver, where I have happily lived since 1992. I am one of a rapidly growing number of people with electromagnetic hypersensitivity (EHS), and I can no longer tolerate the radiation bombarding our beaches, community centres, libraries, cafés, schools, doctors’ offices and even hospitals. **You might appreciate the irony of someone recovering from brain surgery at VGH for the removal of a life-threatening acoustic neuroma, while being bombarded by the very same radiation known to have caused the tumour in the first place.** I’d prefer not to get another one.



The greenest city in the world? Blue areas show Wi-Fi coverage by just one of several Internet service-providers in Vancouver.

¹ See: <http://bit.ly/1V7KBvd> for an interview with Brundtland on the effects of EMR.

Sitting on the beach, being in nature, riding my bike, going to see a movie, shopping downtown, meeting friends in cafés and browsing in the library were simple things that I used to enjoy but can no longer comfortably do. Far from making the city more user-friendly, you have turned it into a death trap for those who are sensitive to electromagnetic fields (EMFs). In my neighbourhood alone, I know of several other people suffering from EHS—one of them virtually housebound.

Nowhere safe to go, and no safe way to get there

With Wi-Fi now in taxis, in car-sharing coops and on buses, trains, ferries and most commercial airlines, there is not one single form of public transport that those with EHS can safely use. (More accurately, there is not one single form of public transport that anyone with red blood cells and a central nervous system can safely use.) They cannot travel, visit family, go on holiday or even get out of the irradiated city that's making them ill ...without getting even more ill. With nowhere safe to go and no safe way of getting there, those with EHS have effectively been stranded, abandoned and immobilized by the municipal, provincial and federal governments.

Those with EHS are the unwelcome biological indicators of just how unhealthy and unsustainable our radiation-riddled lives have become.

There's a reason that those with EHS go largely unheard, beyond the fact that most are too incapacitated or depleted to fight the status quo. We're the 'canaries in the coal mine'—the harbingers of what's to come—and nobody wants to be bothered by facts that would burst their electronic bubble.

Does this ring a Bell? It Shaw does. Telus more!

Given the vast body of scientific evidence of the harm caused by Wi-Fi and other forms of EMR, it is clear that you, the government and service-providers such as BC Hydro, Telus, Shaw and Bell have **failed utterly in your responsibility to acknowledge the dangers and take the appropriate measures to protect our well-being.**

I'm not sure which is more reprehensible—denying that there is any danger, when you know otherwise, or failing to inform yourself by doing the proper research. Relying on the misleading and inaccurate information promoted by the service-providers is unacceptable, particularly in an elected city mayor whose campaign promise included “protecting human health”.

You are, in fact, promoting harm. Many young mothers carry their baby—and their cell phone—in a body sling. There's a whole generation of babies being exposed to dangerously high levels of radiation from cell phones that are not even an inch away from their tiny bodies. If this radiation harms mature adults (and we *know* it does), what's it doing to these fragile infants?

“[Health Canada is] either giving you partial information or giving you misinformation [regarding whether Wi-Fi radiation is safe for children]. Because there is scientific consensus that microwaves [used for Wi-Fi] cause biological effects. [...] And there is no evidence whatsoever that it is safe for children.”

—Dr Zory Glaser (PhD), formerly head of the US Navy Microwave Laboratory and FDA advisor, serving on the Technical Electronic Product Radiation Safety Standards Committee

Evidence of harmful effects: quick facts*

- There is now **10 billion times more radiation** in our environment than there was in the 1960s.
- If current trends continue, **50% of the population** in Austria, California, England, Ireland, Germany and Sweden will be feeling the effects of electromagnetic radiation by 2017. Canada will be no different.
- Swisscom, the Swiss telecommunications company, says non-thermal wireless radiation **“has a genotoxic effect”**, causing **“clear damage to hereditary material [DNA]”** and an **“increased cancer risk”**.
- **EMR adversely affects the blood cells of ALL individuals**, whether they feel the effects or not.
- **EMR damages cell membranes**, causing them to **leak calcium** and create many health issues, such as **altered brain function, autism, infertility, EHS, hypocalcaemia, DNA damage, thyroid problems, osteoporosis, endocrine imbalances, early dementia, asthma, neurological disorders and multiple chemical sensitivities**.
- **Autism in children is doubling every five years**, paralleling the rise of EMR, and there is now a **1-in-50 chance** of a child developing or being born with autism in North America.
- **Almost every grade in every elementary school** in North America has **at least one child with autism**—a disorder that was nearly unheard of a generation ago (<http://usat.ly/NZXMIi>).
- Electromagnetic radiation **breaks down the all-important blood–brain barrier**, causing the death of neurons, which can result in **early dementia** and **Alzheimer’s disease**.
- Just 5 minutes of Wi-Fi exposure can cause **cell mutation, oxidation and rouleaux**—all of which are associated with **illness and disease**.
- The average cumulative whole-body exposure from a Smart meter at 3 feet is about 100 times more than that from a cell phone (see <https://goo.gl/Po9e6K>, at minute 2.17).

** See elsewhere in this document for references to the studies/data confirming these facts.*

Even if I were ignorant of the damaging impact of radiation, my body registers the physical effects whenever I'm near a Wi-Fi or cell phone signal. Since purchasing a meter that detects radio-frequency (RF) and other forms of harmful radiation, I've finally made the causal connection between Wi-Fi radiation and my symptoms—the headaches, tension, neurological issues, electrical 'zapping', premature aging, high oxidative stress, insomnia and fatigue I've been experiencing for years. These are the classic bio-markers/symptoms of EHS, recognized by medical experts and researchers worldwide.

Instantly penetrating cement, metal, plastic, clothing, cars, bone, muscles, tissue and skin, electromagnetic radiation affects us all within minutes.

Electromagnetic hypersensitivity appears in two stages, explains French oncologist Dr Dominique Belpomme. "The first phase is induced by exposure to a specific EMF frequency—either an acute or chronic exposure, such as talking on a cell phone 20 minutes every day. The first signs of hypersensitivity [due to cell phone use] are pain and a heat sensation in the ear. In the second phase, the disease sets in. That's when you become intolerant at all frequencies."

Once upon a time...

...the Earth was flat. Smoking was good for you. Thalidomide was great for morning sickness. Asbestos made for excellent insulation. Nuclear power was the way to go. GMO crops were a godsend to farmers everywhere. And hydrogenated oils were a cost-effective choice. Now, we have Wi-Fi and mobile networks, connecting us with everyone, everywhere, every second of every day... and creating a pervasive, virtually inescapable, unprecedented, unchecked, uncontrolled and rapidly escalating proliferation of radiation in our environment. But don't worry; the Mayor of Vancouver says it's safe!²

Like so many of those unfounded claims, Wi-Fi is now being promoted as a safe and beneficial technology in industry-sponsored studies and PR. Consequently, the media have featured many misleading, inaccurate and incomplete reports about Wi-Fi radiation, claiming that there is *no apparent causal relationship* and that there is *zero evidence* supporting the experiences of those with EHS.³ Such claims merely reveal the reporters' ignorance of the latest research—and perhaps their own addictive love affair with their iPhone. Some have claimed that reactions to electromagnetic radiation are *psychosomatic*, which is an insult to the countless individuals who had no idea that EMR was causing their illness and only discovered the very clear 'causal relationship' after years of research, functional impairment, huge expense and misdiagnosis.

Nonetheless, such theories are likely to be hugely reassuring to those who are unaware of the FACTS.

² See <http://bit.ly/1svnHmQ> for a small sample of the compelling evidence to the contrary.

³ See, for example, <http://bit.ly/1RNGwe0>.

Scientific fact versus political spin and misinformation

SPIN: Non-ionizing Wi-Fi radiation does not generate enough heat to do damage and, therefore, this non-thermal form of radiation is not harmful to humans.

FACT: Scientific studies—and the telecommunications industry itself—confirm that non-thermal radiation is harmful to the human body.⁴

- “Weak non-ionizing electromagnetic radiation in the environment can be linked to more ‘modern illnesses’ than even the pessimists thought possible,” says Dr Andrew Goldsworthy. “Modern science can now begin to explain how.” (For details, see: <http://bit.ly/1taEDi3>.)
- The American Academy of Environmental Medicine reports that: “epidemiological studies demonstrate that **significant harmful biological effects** occur from non-thermal RF exposure” (<http://bit.ly/24XtlpS>).
- A **Swisscom patent** application clearly states that **non-thermal wireless radiation “has a genotoxic effect ... elicited via a non-thermal pathway”** and that “when human blood cells are irradiated with electromagnetic fields, clear **damage to hereditary material [DNA]** has been demonstrated [with] indications of an **increased cancer risk.**” The international patent (<http://bit.ly/1OQbG4V>), filed in 2003, was for technology to reduce the ‘electrosmog’ from wireless local networks, intended to reduce the cancer risks associated with non-thermal exposure to microwave radiation. (For more details, see: <http://bit.ly/1BCVa0W>.)
- A **British epidemiological study (confirmed by Swedish, Japanese and Italian findings)** shows an association between long-term use of a cell phone and **acoustic neuromas** (<http://microwavenews.com/uk-study-points-acoustic-neuroma>). Although acoustic neuromas (which grow on the eighth cranial/auditory nerve) are ‘benign,’ they can still kill you.

A \$25m study by the National Toxicology Program of the NIH found that cell phone radio frequency radiation caused two types of tumours: glioma and schwannoma [acoustic neuromas].

<http://goo.gl/eN6hKo>

⁴ Dr Andrew Goldsworthy has produced compelling, comprehensive accounts of the multiple effects of EMFs, referencing over 70 scientific studies, the dangers of electromagnetic smog, and why the body is affected the way it is (see <http://bit.ly/1PIASJZ>; <http://bit.ly/28ltGL9>; and <http://bit.ly/1taEDi3>).

SPIN: Extremely low frequency (ELF) radiation has no significant health effects.

FACT: The electromagnetic fields that are most harmful to humans are those in the ELF range and also the radio frequencies that are pulsed or amplitude-modulated by ELF (see <http://bit.ly/1PLASJZ> for following three points).

- ELF radiation has been scientifically proven to **damage cell membranes**, causing them to leak calcium and create many health issues, such as **altered brain function, autism, infertility, EHS, hypocalcaemia, DNA damage, early dementia, asthma and multiple chemical sensitivities**.
- Electromagnetic radiation can break the **all-important blood-brain barrier**, causing the death of neurons, which can result in **early dementia and Alzheimer's disease**.
- Gland cells are particularly sensitive to radiation, which can **damage the thyroid and endocrine system, disrupting the metabolism**. Even short-term exposure to radiation from a cell phone tower was shown to **increase cortisol levels**, with long-term exposure resulting in **permanently elevated adrenaline**.
- EMFs disrupt the production of melatonin, the body's only antioxidant, resulting in high levels of damaging **free radicals/oxidative stress and accelerated aging**.⁵
- Inward calcium leakage in the neurons of the brain stimulates hyperactivity and makes the brain less able to concentrate on tasks, resulting in **attention deficit hyperactivity disorder (ADHD)**.⁶

“International exposure guidelines for electromagnetic fields must be strengthened to reflect the reality of their impact on our bodies, especially on our DNA. The time to deal with the harmful biological and health effects is long overdue. We must reduce exposure by establishing more protective guidelines” (see Appendix 1).

⁵ Henshaw, DL and Reiter, RJ (2005). Do magnetic fields cause increased risk of childhood leukemia via melatonin disruption? Bioelectromagnetics Supplement 7: S86-S97.

⁶ Beason and Semm, 2002; Krey and Dolmetsch, 2007; Volkow et al, 2011.

SPIN: There is no demonstrable medical proof of harm being caused by Wi-Fi or Smart meters.

FACT: The damaging effects of RF radiation from cell phones, Wi-Fi and Smart meters can now be medically demonstrated.

- The damage done to red blood cells from brief exposure to RF radiation can be seen via live-blood-cell (dark-field microscopy) analysis, which reveals cell mutation, **oxidation and rouleaux** (aggregation of red blood cells) (<https://youtu.be/y4JDEspdx58>).
- Just 5 minutes of exposure to Wi-Fi radiation results in cellular damage associated with **pathological processes** (see: <https://vimeo.com/100623585>, at minute 4.48).
- According to the *BioInitiative Report*,⁷ bioeffects occur within minutes and at very low levels of exposure to EMFs and RF radiation—similar to those from cell and cordless phone use, as well as exposure to mobile phone masts (cell towers), Wi-Fi and wireless utility Smart meters that produce whole-body exposure. Chronic base-station-level exposures have also been shown to result in illness (<http://bit.ly/1Xn4ZIV>).

“WHO continues to ignore its own agency’s recommendations and favours guidelines recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). These guidelines, developed by a self-selected group of industry insiders, have long been criticized as non-protective” (see Appendix 1).

⁷ The 2012 *BioInitiative Report* was prepared by 29 authors (including 10 MDs, 21 PhDs, 3 MsCs, MAs or MPHs) from 10 countries (Austria, Canada, Denmark, Greece, India, Italy, Russia, the Slovak Republic, Sweden and the USA). Among the authors is the Chair of the Russian National Committee on Non-Ionizing Radiation, and a Senior Advisor to the European Environmental Agency.

SPIN: Only vulnerable, hypersensitive or weak individuals are affected.

FACT: The damaging effects of EMR have been medically proven to occur in every human body.

- Dr Erica Mallery-Blythe, a former A&E doctor now specializing in EHS, says these **effects occur even in those not experiencing symptoms**, and many of us may be electro-hypersensitive and not realize it. “Everybody has the potential to become electro-hypersensitive [since] **every cell in our body, in our brain or nervous system is dependent on electrical signals**” (<http://www.dailymail.co.uk/femail/article-2331369>).
- Countless other doctors (such as Dr Dietrich Klinghardt⁸ and Dr Andrew Goldsworthy) confirm that **EMR affects the blood cells of all individuals**, ultimately damaging their nervous systems, brains, reproductive organs and physical health.

MYTH #5: The supposed effects of EMR are intangible and cannot be objectively measured.

FACT: Medical doctors and researchers have identified biomarkers of EMF intolerance—biological indicators of EMR damage, found in everyone suffering from EMF sensitivity, as well as in those who had no idea that such a thing existed or that it could be making them ill.

- Exposure has been found to have a **damaging impact on melatonin, serotonin, dopamine, adrenaline, cortisol, testosterone, progesterone, T3 and T4 thyroid hormones and plasma ACTH** (which regulates cortisol) (<http://bit.ly/1rXJUcC> and <http://www.magdahavas.com/>), among many others (see diagram on the main physical effects).
- Dr Dietrich Klinghardt⁹ tests for particular biomarkers in those affected by EMF pollution: an **increase in inflammation markers** (TGF-Beta 1, MMP-9 and copper, which shows chronic inflammation, **hormone abnormalization and neurotransmitter abnormalization**) (<http://bit.ly/1Sc8I8G>).
- Other medical tests for detecting EMF effects include live-blood-cell analysis, brain and nervous system analysis, and cardiac analysis (<https://www.emfanalysis.com/ehs-biomarkers/>).

⁸ Dr Dietrich Klinghardt, MD, PhD, is Founder of the Klinghardt Academy (USA), the American Academy of Neural Therapy, Medical Director of the Institute of Neurobiology, and lead clinician at the Sophia Health Institute (Washington State). He is also Founder and Chairman of the Institute for Neurobiology (in Germany & Switzerland). See <https://youtu.be/PktaaxPI7RI> and <http://www.klinghardtacademy.com/>

⁹ See <https://youtu.be/PktaaxPI7RI> and <http://www.klinghardtacademy.com/>.

SPIN: When those with EHS were asked to detect the presence of cell phone radiation, from behind a curtain or closed door, they often couldn't tell when the radiation was present, or they reacted even though the cell phone hadn't been switched on—which proves that it's all in their heads.

FACT: This approach has since been invalidated, for several reasons. Many individuals with EHS can physically feel RF radiation, although they often don't know that that's what they're feeling. Even those who feel nothing, however, are still being affected at the cellular level.

- Most people feel nothing, since the effect occurs at the cellular level, beyond their conscious awareness. Only in those with sensitized nervous systems, or those for whom the strength/duration of exposure has created physical symptoms, will the effects be felt.
- To claim that people react physically to the mere suggestion of EMF exposure merely reveals an **ignorance**—not just of **how EMFs affect the human body at the cellular level**, but of human nature itself. If you have a fear of spiders, heights or small spaces, and you're told that you might be given a tarantula, placed on a cliff or locked in a closet, you would instinctively experience anxiety, sweating and other physiological stress responses, whether those threats materialized or not. Yet the danger posed by EMR is very real and a fear of it is well founded.
- As Dr Mallery-Blythe points out: “Electromagnetic hypersensitivity is a **physiological issue, not a psychological one** [and] it can be seen as either a sickness or a super-sense, depending on the environment of the individual, although it is essentially both” (<https://vimeo.com/100623585>).
- French oncologist Dr Dominique Belpomme concurs: “**We know with certainty that electromagnetic hypersensitivity is not psychosomatic.**”

If you don't feel the effects, you won't care.

If you don't care, you won't look.

If you don't look, you won't see.

If you don't see, you won't believe.

But the evidence is there.

SPIN: Service-providers claim that Wi-Fi/cell phone/Smart meter radiation is safe, and the media haven't reported anything conclusive, so there's no need to worry.

FACT: Thousands of scientific studies attest to the damage caused by RF and other forms of radiation.

- The results of many of these studies have been published in reputable medical and scientific journals such as *The Lancet*, *the International Journal of Neuroscience*, *the Journal of Applied Sciences Research*, *Electromagnetic Biology and Medicine* and *NeuroToxicology*, among others (<http://nutritionalbalancing.org/center/environment/articles/emf-emr-health-effects#ref>).
- Studies find adverse biological effects from Wi-Fi frequencies (2.4 or 5GHz), with exposures of <16V/m (such as those from a Wi-Fi-enabled device): <http://bit.ly/1jsIPUp>.
- **A \$25m study by the National Toxicology Program of the NIH found that cell phone radio frequency radiation caused two types of tumours: glioma and schwannoma (acoustic neuromas).**¹⁰
- “EMFs provoke major effects in the brain,” says oncologist Dr Dominique Belpomme. “The most important of these is the opening of the blood–brain barrier. This allows mercury, organochlorines and other pollutants to enter the brain, where they cause various neurodegenerative diseases.”¹¹
- While some reports in the media strive to prove that EMR doesn't harm us, doctors and specialists around the world are quietly helping those whose lives have been torn apart by the very real and devastating phenomenon of electromagnetic hypersensitivity. For a timeline of growing awareness of/landmark rulings re EHS, see: <http://www.emfwise.com/awareness.php>.
- Associate Professor Dr Olle Johansson, a neuroscientist at the Karolinska Institute in Sweden who has been researching the biological effects of RF wireless radiation for more than 30 years, predicts a “paradigm shift” in attitudes towards EMF. Our environment currently has about 10 billion times more RF radiation than it did in the 60s. “If this environment is safe,” Johansson says, “we're talking about **15,000–25,000 papers—in peer-reviewed scientific journals**—all being wrong. That has never happened before.”

¹⁰ www.saferemr.com/2016/05/national-toxicology-program-finds-cell.html

¹¹ See: <http://goo.gl/RCiYLa>

Key physical effects of EMR¹²

1. **Nervous system disruption**, which sends the body into a perpetual fight-or-flight response and prevents it from resting, repairing, healing or regenerating normally.
2. **Reduced production of melatonin**—the body's sleep hormone, required for healthy sleep cycles. Melatonin is also the body's only natural antioxidant. When it is depleted, it causes oxidative stress and accelerated aging due to harmful free radicals.
3. **Impaired immune system**, in the form of decreased natural killer cells and other white-blood-cell damage.
4. **Reproductive problems**, due to sterility, infertility issues and hormonal disruption.
5. **Breakdown of the blood–brain barrier**, causing the death of neurons, which can lead to early dementia, Alzheimer's disease, ADHD and autism.
6. **Increased cerebral glucose metabolism**, also linked to Alzheimer's (known as 'diabetes of the brain').
7. **Oxidative stress and chronic inflammation**, which affect all the body's organs, causing numerous degenerative and other conditions such as cancer, diabetes, osteoporosis, heart disease, rapid aging and arthritis.
8. **Inhibition of repair mechanisms**, preventing the body from recovering or healing normally.

The key symptoms of EHS

- Insomnia/sleep disturbances
- Headaches, sharp pains, tingling, numbness
- Pressure in head/throat/chest/ears, tinnitus
- Dizziness, balance issues
- Electrical buzzing or 'zapping' in head
- Visual/hearing disturbances, eye irritation
- Short-term memory loss, mental/thought block, concentration problems
- Skin rashes, eczema
- Chronic dehydration, insatiable thirst
- Altered heart rate, palpitations, blood pressure anomalies
- Tremors, tics, seizures
- Extreme fatigue
- Joint dysfunction, musculoskeletal pains
- Increased chemical sensitivity and/or allergies
- Sensory overload, inability to rest/relax/heal

¹² Diagnosis and management of electromagnetic hypersensitivity (EHS): rapid overview for a mixed audience—a highly informative presentation by Dr Erica Mallery-Blythe at the British Society of Ecological Medicine convention in March 2014 (<https://vimeo.com/100623585>).

Sound familiar?

If you're experiencing any of these symptoms, it may *not* be because of electromagnetic radiation. However, the likelihood of them being caused or exacerbated by EMR is increasing every day, even though most of the effects go misdiagnosed, undiagnosed and/or are 'treated' with drugs. According to Dr Mallery-Blythe, some features of EHS require emergency management, such as seizures, cardiac chest pain and malignant arrhythmias, among others. There are also some hallmark signs of EHS, she says, such as body hotspots with increased sensitivity (such as the right ear, from using a cell phone, or the right hand, from using a computer mouse); chemical sensitivity; and temporary relief from bathing/showering, which has a grounding effect on the body.

Is this getting on your nerves?

The incidence of chronic neurological illnesses is rapidly increasing, with autism in children *doubling every five years*, according to Dr Dietrich Klinghardt.¹³ And he knows why. "The only thing that parallels the exponential increase in chronic neurological illness is the increased exposure to manmade electromagnetic fields—largely in the high-frequency range from cell phone radiation, the Tetra network [...] Smart meters..." With credentials, expertise and medical specializations too extensive to list, Dr Klinghardt is a recognized authority on EHS and the **many diseases (ALS, Parkinson's, MS, autism etc) exploding out of control, due to the widespread proliferation of radiation**. He has identified the biomarkers of EHS, adding considerably to the research carried out over the past 80 years—most of it showing biological damage being done by EMR. "As a scientist, you don't have to look very far," he says.

How far have the 'scientists' working for Telus, Bell, Shaw, BC Hydro, you or Justin Trudeau looked, Mr Robertson? The evidence is now so vast and compelling that it would be hard for any diligent researcher not to be daunted by the sheer volume of data. Service-providers and politicians who ignore this crucial evidence do a huge disservice to humans everywhere, while often vilifying, patronizing and insulting those with EHS.

You make me sick!

I'm sorry to put it like that... but shouldn't **YOU** be apologizing to **ME**? You—my neighbour, my colleague, my friend, the commuters surrounding me on the bus, the six other people in the elevator with me, and you—the Mayor of Vancouver—all pumping out massive amounts of radiation into our shared environment, which you have rendered so unhealthy that I can no longer inhabit it.

Let's be absolutely clear about this: I'm not the problem. I'm merely a symptom of what's wrong. It's not the *individual* that's sick, disabled or dysfunctional as a result of EMF 'sensitivity'; it's the

¹³ See <https://youtu.be/PktaaxPl7RI>

environment. In Sweden, those with EHS are not considered to have a disease but a functional impairment resulting from the inhospitable environment in which they live (see, for example: <http://1.usa.gov/1TYtbib>).

Getting greener ...or simply sicker?

While you and Justin Trudeau diligently focus your efforts on reducing the effects of climate change, you might wish to consider the far more pressing reality flagged by Dr Robert O. Becker, MD and scientist, twice nominated for the Nobel Prize: “...**the greatest polluting element in the Earth’s environment is the proliferation of electromagnetic fields**” [EMFs], which is “**far greater, on a global scale, than warming and the increase in chemical elements in the environment.**”

Some EHS doctors claim that *80% of all illnesses* are associated with electromagnetic radiation. They say that headaches, inflammation, insomnia, ADD/ADHD, neurological disorders and countless other conditions are caused or exacerbated by the escalating levels of radiation in our environment. Even autism, they say, has been shown to develop in children newly exposed to Wi-Fi.

Before they even *speak* to their patients, doctors with Wi-Fi/cell phones in their offices are effectively violating their oath to do no harm.

Important landmarks on the EMF lifeline

- “Studies show that 10–50% of the population [in France—i.e., 30 million people] may become very intolerant to EMFs over the next 25 to 50 years,” says French oncologist, Dr Dominique Belpomme,¹⁴ yet this projection is already (as of 2016) very much out of date.
- **The figures are far higher**, says Dr Erica Mallery-Blythe, based on new data showing that the **effects of EMR will be felt much more immediately—by 2017—in about 50% of the population in Austria, California, England, Ireland, Germany and Sweden**—and even that projection may be a gross underestimation.
- **Sweden officially recognized EHS as a functional disability in 2002.** Aware that it's not the *individual* that is sick, but the *environment*, the Swedes have special EMF-free communities, legal mechanisms and government subsidies for those with EHS.
- **Wi-Fi has been banned/severely restricted in many schools** in Switzerland, France, Germany and other European countries.
- In 2009, the **European Parliament voted for persons with EHS to be recognized as disabled.**
- In 2011, the WHO/International Agency for Research on Cancer (IARC) **classified RF radiation as possibly carcinogenic to humans** (Group 2B), based on **an increased risk of glioma** (a malignant type of brain cancer), associated with wireless phone use. **Acoustic neuromas** have also been found to result from Wi-Fi radiation exposure.
- A Spanish labour court decreed a college professor to be permanently incapacitated by EHS, in 2011.
- In May 2015, **Lloyd's of London informed British schools that it was excluding liability coverage** for injuries “resulting from or contributed to by electromagnetic fields, electromagnetic radiation, electromagnetism, radio waves or noise”, which means that **school officials could be personally liable for exposing children/staff and staff to microwave radiation** (<http://bit.ly/1XX2Qo4>).
- The Canadian authorities must have briefly ‘seen the light’, back in June 2007, when the **Canadian Human Rights Commission approved a Policy on Environmental Sensitivities** that *also recognized EHS as a disability*. Clearly, that initial awareness has since been cancelled out by powerful political and industry forces.

¹⁴ See <http://goo.gl/RCiYLa>

Human rights and human wrongdoings

The Policy on Environmental Sensitivities states that **“those living with environmental sensitivities are entitled to the protection of the Canadian Human Rights Act, which prohibits discrimination on the basis of disability.** The Canadian Human Rights Commission will [...] process any complaint from any person who believes that he or she has been discriminated against because of an environmental sensitivity. Like others with a disability, **those with environmental sensitivities are required by law to be accommodated**” (http://www.chrc-ccdp.gc.ca/sites/default/files/policy_sensitivity_0.pdf) (for further details, see Appendix 1).

In accordance with the **United Nations Convention on the Rights of Persons with Disabilities**,¹⁵ Canada has an obligation to respect the following principles (with particular relevance to EHS):

- a. Respect for inherent dignity, individual autonomy including the freedom to make one's own choices, and independence of persons;
- b. Non-discrimination;
- c. Full and effective participation and inclusion in society;
- d. Respect for difference and acceptance of persons with disabilities as part of human diversity and humanity;
- e. Equality of opportunity;
- f. Accessibility;

It must also undertake:

- a. To adopt all appropriate legislative, administrative and other measures for the implementation of the rights recognized in the present Convention;
- b. To take all appropriate measures, including legislation, to modify or abolish existing laws, regulations, customs and practices that constitute discrimination against persons with disabilities;
- c. To take into account the protection and promotion of the human rights of persons with disabilities in all policies and programmes;
- d. To refrain from engaging in any act or practice that is inconsistent with the present Convention and to ensure that public authorities and institutions act in conformity with the present Convention;
- e. To take all appropriate measures to eliminate discrimination on the basis of disability by any person, organization or private enterprise;

The provisions of the Convention extend to all parts of federal states, without any limitations or exceptions. In order to promote equality and eliminate discrimination, Canada (along with the other signatories) must take all appropriate steps to ensure that reasonable accommodation is provided.

¹⁵ See: <http://goo.gl/aEJF1>

According to the **BC Human Rights Code**, landlords, service-providers and other decision-makers have a legal obligation to accommodate those with a disability—including EHS.

What accommodation are you making for those with EHS?

Where can we safely enjoy the amenities available to everyone else in the city, without being incapacitated, excluded or otherwise discriminated against, due to Wi-Fi radiation?

What steps are you taking to eliminate the discrimination of those with EHS, in all of the ways described herein?

“...persons with the functional impairment electrohypersensitivity [have the right] to live an equal life in a society based on equality.”

—Dr Olle Johansson, a neuroscientist
at the world-renowned Karolinska Institute in Sweden

If EHS results from the body's natural reaction to harmful electromagnetic radiation (as demonstrated via blood analysis¹⁶), then discrimination of those with this 'functional impairment' denies the basic principles of human physiology, which constitutes discrimination against the human body itself.

Although being exposed to harmful radiation without one's consent and beyond one's control is clearly a violation of one's human rights, it's hard to determine just how many of those rights are being violated. There's the right to equal opportunity, the right to sustain a livelihood, the right to access all the services and amenities available to non-EHS citizens, the right to good health, the right to live in a safe environment, the right to choose whether to be exposed to harmful radiation and maybe even the right to exist, given the foregoing. It might even be considered a denial of our very humanity, given our natural reaction to radiation and the body's inevitable tipping point of intolerance for the ever-escalating levels. We all have tipping points of intolerance—for alcohol, sugar, carcinogens and toxins, as well as for politicians such as Harper or any other public officials who fail to serve our best interests.

¹⁶ Observable effects of RF/MW radiation from Smart meters: cell mutation, oxidation and rouleaux (aggregation of red blood cells), shown through live-blood-cell (dark-field microscopy) analysis. See <https://goo.gl/Nvdpqz>.

Prelude to pathology

It's really quite simple, and it all boils down to this: human blood cells are adversely affected by EMFs. To tout 'safe' standards, to contest the human rights angle, or to resort to transparent, legal grasping in an attempt to disprove the harm caused is unnecessary and irrelevant. Anyone can put a drop of their blood under a high-powered microscope and see for themselves the damage done—as have numerous laypersons, researchers and doctors, including bestselling author Dr John Gray. “With high EMF exposure, blood cells become sluggish and congested,” he says. “When I heard about this [EMF] research, I went out and bought an expensive microscope to test this. I saw this with my own eyes.” The damaged cells (indicating oxidation, cell mutation and the formation of rouleaux) are the precursors to illness and disease. **No further proof is required. While it's certainly a legal issue, it's primarily a physiological, humanitarian one.**

Let's get personal...

What would it take for you to acknowledge the dangers of EMR? If your daughter Hanna developed autism, ADHD or maybe even MS, would that do it? What if *you* started experiencing inexplicable symptoms, to the point where you could no longer work or function normally? Does that seem too personal a question? Every minute of every day, I'm exposed to intense, pervasive, inescapable radiation, sanctioned and promoted by you, with progressively damaging effects on my body and my life. It doesn't get much more personal than that, Gregor.

Let's explore a few more scientific facts. Do you know how much radiation is emitted by your cell phone, your laptop, your iPad or your cordless phone? And if you're exposed to multiple Wi-Fi signals at once, from multiple sources, do you know how much radiation that would be?

I asked a physicist about this, and here's what he said:

When looking at signal strengths on phones or routers, the number of bars is not linearly related to the strength of the field. Thus, bar 4 may be 10 times stronger than bar 3, which may be 10 times stronger than bar 2, which may be 10 times stronger than bar 1. However, bar 5 may be 1,000 to 100,000 times stronger than bar 4. In reality, one signal might be 19mW/m², another 13mW/m², and the others around 2mW/m², with all 10 signals registering as 4 bars. Your total exposure would then be 48mW/m². [Most researchers/doctors specializing in EHS recommend levels of no more than 1mW/m², for prolonged exposure.] Since the number of bars is arbitrary and can cover a wide range of signal strength, there is no simple way to add them. The greater the duration/strength of the signal, the more it interacts with your body.

This raises numerous questions about the rapidly rising RF radiation levels in public spaces and what you're doing to limit the radiation before it becomes intolerable for most human beings.

Questions for you and the government to answer

- Given the data above, how can you ever determine the level of Wi-Fi radiation anywhere, at any time, if you don't know how many devices are being used or at what strength?
- What is the current level of Wi-Fi radiation downtown, in the public library, in Vancouver General Hospital, or in a multi-dwelling residence where everyone has their own Wi-Fi routers, cell phones and countless other wireless devices generating their own strong signals?
- Are you/your team keeping track of the levels? When and how do you measure them? And do businesses have to report back to you if they 'go Wi-Fi' and add to the existing cumulative load, in any one location?
- Do you do all this testing and research in secret or at night? Or do you rely on what others have reported as being 'safe'? (I've never seen you or any other public official carrying an RF meter for testing the Wi-Fi radiation levels around you.)
- Can you tell me how much radiation I'm exposed to, at any given time, in any given place? Do you know what's healthy or tolerable for me—for my particular body, with its unique, individual characteristics and tolerances? Will you call me when the levels go beyond what you think I can personally tolerate?
- What about when I'm in an elevator with 8 other people, all using their iPhones, which generate dangerously high levels of radio-frequency radiation, with a reach of 20–40 feet, in a tiny 8' x 10' space, far exceeding what could conceivably be considered healthy for anyone?
- What do you recommend for the rapidly growing number of people like me who cannot consult a naturopath, or even go to VGH, since WiFi is now everywhere, thanks to you? What do you suggest they do, if consulting the medical profession worsens the condition for which they are seeking medical help?

- Do you realize that you will never know the full impact of your campaign, since many of those with EHS are so incapacitated that they have either fled the city, are too sick to fight back, or cannot even use their computer?
- Do you take responsibility for the fact that you've not only allowed all citizens to be bombarded with harmful radiation, beyond their control, but have also led them to believe that Wi-Fi radiation is safe and that they can use their numerous electronic devices as often as they like, without any ill effects?
- Do you, in your role as a public servant, feel confident that you can tell me what I can or cannot safely do, even if you haven't done the necessary research? How many of the thousands of medical/scientific studies, confirming the damaging effects of EMR, have you actually read?
- Is it possible to make Vancouver '*the greenest city in the world*' while simultaneously bombarding it with the kind of radiation that has been shown to prevent the healthy growth of plants and trees, not to mention human beings?¹⁷
- What about the explosive growth of new Wi-Fi technologies and gadgets—with self-driving wireless cars soon to be on the market? Have you established the level at which the ambient radiation will have to be capped, to prevent a catastrophic epidemic of sickness, disability and neurological disorders?
- Have you estimated the cost of this to the healthcare system, which will ultimately be paid for (financially and in immeasurable other ways) by all Canadians?

**The scientific evidence of the harm caused
by electromagnetic radiation is irrefutable.
There is no longer any doubt, just denial.**

¹⁷ See: <http://bit.ly/1dy9fwt> and <http://goo.gl/PO2yiV>.

I would genuinely like to know why you think that you—and Shaw, Bell, Telus, BC Hydro etc—can violate my most fundamental rights as a human being, subjecting me to harmful radiation, without my permission and beyond my control, causing functional impairment, hearing loss, nervous-system dysregulation, neurological disruption, organ damage, pain, social isolation, financial loss, rapid aging, illness and despair. Please advise.

While I'm rightfully angry about that, I also regret not taking this far more seriously, far sooner than I did. Even though I could feel electrical buzzing in my head, when exposed to Wi-Fi signals, I didn't know I had an *acoustic neuroma* growing in there—or even that such things existed. My ignorance and lack of awareness cost me dearly.

I urge you not to make the same mistake.

Sincerely,

A handwritten signature in black ink, appearing to read 'Olga', with a long horizontal line extending from the end of the signature.

Olga Sheean
olga@olgasheean.com

PS: I respectfully request that you not insult my intelligence, increase my stress or further decrease my life expectancy by diminishing, dismissing or invalidating the very real, rapidly escalating, unmonitored and immeasurable dangers of electromagnetic radiation, or the vast body of irrefutable medical and scientific evidence attesting to its damaging impact on human life.

PPS: I almost forgot: where should I send the bill? In the last four years alone, I've spent over \$25,000 on specialists, medical tests, therapies, supplements and EMF-shielding fabrics and devices. Being unable to work normally since undergoing brain surgery has cost me at least \$250,000. The ongoing costs to my relationship, health, well-being, friendships, business, social life, mobility, longevity and quality of life are inestimable. But let's just round it all down to a nice easy \$2 million. Should I send the bill directly to you, so you can split it with your buddies at Shaw, Bell, Telus and BC Hydro? Please let me know.

A taste of what's to come: the real cost of electromagnetic radiation

Available data indicate that, if current trends continue, 50% of the population of many developed countries will, by 2017, be feeling the effects of electromagnetic radiation. Canada is no exception. In Metro Vancouver alone, almost 1.3 million people would be affected, and these are just some of the changes you can expect to see:

- **the incidence of illness will rise dramatically**
- **healthcare costs will soar**
- **healthcare and government services will be unable to cope**
- **absenteeism will increase exponentially**
- **performance, expertise, focus and concentration will suffer**
- **more human error and accidents will occur in all areas of life**
- **shortages will occur in skilled/unskilled labour**
- **businesses will flounder/go under**
- **the incidence of autism in children will skyrocket**
- **more and more people will take drugs to try to control symptoms**
- **young people will have increasing hormonal problems/infertility**
- **adults will age rapidly and leave the workforce early**
- **an increasing percentage of the population will be on disability/pension**
- **home-owners will default on loans**
- **local and national economies will suffer**
- **markets will founder or collapse**
- **lawsuits, lawsuits, lawsuits...**

Appendix 1: Scientists call for more protective measures, given increasing evidence of risk from EMFs

In May 2015, 190 scientists from 39 nations submitted an appeal to the United Nations, UN Member States and the World Health Organization (WHO) requesting that they adopt more protective exposure guidelines for electromagnetic fields (EMFs) and wireless technology in the face of increasing evidence of risk.

All of the scientists have published peer-reviewed papers on the biological or health effects of non-ionizing radiation—part of the EMF spectrum that includes extremely low frequency (ELF) fields used for electricity, or radio frequency (RF) radiation used for wireless communications. The appeal was launched by Dr Martin Blank, who has over 30 years' experience conducting EMF research at Columbia University and is former president of the International Bioelectromagnetics Society. He gives a compelling explanation of the major health crisis we are facing due to increasing levels of environmental pollution from growing and expanding EMF sources.

The appeal calls for precautionary measures, to limit EMF exposures, and to educate the public about health risks, particularly to children and pregnant women, and asks the United Nations, WHO, UNEP and UN Member States to:

- address the emerging public health crisis related to cell phones, wireless devices, wireless utility meters and wireless infrastructure in neighborhoods; and
- urge that the United Nations Environmental Programme (UNEP) initiate an assessment of alternatives to current exposure standards and practices that could substantially lower human exposures to non-ionizing radiation.

“International exposure guidelines for electromagnetic fields must be strengthened to reflect the reality of their impact on our bodies, especially on our DNA,” says Dr Blank. “The time to deal with the harmful biological and health effects is long overdue. We must reduce exposure by establishing more protective guidelines.”

The appeal highlights WHO's conflicting positions about EMF risk. WHO's International Agency for Research on Cancer classified radiofrequency radiation as a Group 2B “possible carcinogen” in 2011, and extremely low frequency fields in 2001. Nonetheless, WHO continues to ignore its own agency's recommendations and favours guidelines recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). **These guidelines, developed by a self-selected group of industry insiders, have long been criticized as non-protective.**

Dr Joel Moskowitz, PhD, of University of California, Berkeley, says: “ICNIRP guidelines set exposure standards for high-intensity, short-term, tissue-heating thresholds. These do not protect us from the low-intensity, chronic exposures common today.”

The appeal calls on the UN to strengthen its advisories on EMF risk for humans and to assess the potential impact on wildlife and other living organisms under the auspices of the UN Environmental Programme, in line with the science demonstrating risk, thereby resolving this inconsistency.

See: <http://www.emfscientist.org> and <http://goo.gl/sLi7Uu>

Appendix 2: Excerpts from the Canadian Human Rights Commission report, Accommodation for Environmental Sensitivities: Legal Perspective

“...the Act’s prohibition of discrimination applies to all employers, providers of goods, services, facilities or accommodations, and employee organizations under the federal jurisdiction of the Canadian Human Rights Commission.

“The Ad Hoc Committee on Environmental Hypersensitivity Disorders, chaired by former Judge George M. Thomson, defined environmental sensitivities as:

a chronic (i.e. continuing for more than three months) multisystem disorder, usually involving symptoms of the central nervous system and at least one other system. Affected persons are frequently intolerant to some foods and they react adversely to some chemicals and to environmental agents, singly or in combination, at levels generally tolerated by the majority... Improvement is associated with avoidance of suspected agents and symptoms recur with re-exposure.

“Individuals with environmental sensitivities experience adverse reactions to environmental agents below the level deemed to be unsafe or to affect people. The causes, symptoms and triggers of environmental sensitivities vary from individual to individual. **The triggering environmental agents are prevalent throughout the built environment and include electromagnetic fields and the chemicals found in building materials, furniture, cleaning and copying products, fragrances, and pesticides.**

“...there is no doubt that individuals experience physical symptoms as a result of environmental agents. Even if environmental sensitivities were triggered by a psychiatric condition, the Act’s guarantee of accommodation to the point of undue hardship and non-discrimination would be equally applicable, albeit potentially with different forms of accommodation. While this paper uses the term ‘environmental sensitivities,’ numerous other terms refer to the same or similar conditions, including ‘multiple chemical sensitivity (MCS),’ ‘chemical injury,’ ‘sick building syndrome,’ ‘environmental illness,’ **‘environmental hypersensitivity,’ ‘electromagnetic field (EMF) sensitivity,’** ‘Gulf War syndrome,’ ‘environmental sensitivity disorder,’ ‘20th century disease’ and ‘environmental allergies.’ Because of the variation in triggers and symptoms, it is preferable to refer to sensitivities in the plural, rather than the singular.

“[In Canada] complainants are required to provide minimal medical evidence to establish that they qualify as persons with a disability, **and individuals with environmental sensitivities do not need to prove the veracity of their condition. In fact, the courts have specifically held that the inability of the medical community to diagnose a condition or identify its cause does not affect whether an individual has a disability, so long as its triggers can be identified.** Instead, the analysis is meant to focus on the individual’s accommodation needs and the behaviour of the employer or service provider.”

Radiation Sickness; Sarah Jane Berd Comments, Aug. 23, 2013

Dear FCC:

I am electromagnetic sensitive and it is affecting my work. This letter I wrote to my Union August 25, 2013.

Hi UE Local 1008:

I had a meeting with Management, on Friday August 23rd, 2013 after I requested to move to another work station after I measured pulsed radiation at 3 second intervals reading over 2000 uW/m².

This issue may be the Achilles heal that gets me fired in the near future.

On Thursday August 22, 2013 I came home very tired, went to bed around 4:00 and slept approximately 15 hours. This is very unusual for me, so I decided to bring in my \$450 dollar HF 35C HF Analyzer to test the radiation at my workstation. Sure enough the radiation readings were going off the range of my meter pulsing every few seconds. Even though I wear EMF protective clothing everyday this is not enough to protect against this strength of radiation. I went to another nearby work station and the readings were at base line. I packed up my things to relocate at the new workstation, trying not to draw attention to myself. Lauren told me that if I did not move back then we would have to have a meeting with management.

Pam informed me that I would need to obtain a doctor's note for any future requests to move my work station due to excessive radiation readings. Which I will do, but it will cost me quite a bit of money.

As you know I have been a passionate activist against Electromagnetic Smog as I believe that I have become electromagnetic sensitive. I was a founding board member of Center for Electrosmog Prevention <http://www.electrosmogprevention.org/> & <http://smartmeterdangers.org/> when we were instrumental in our efforts to obtain an "opt out" for Californian's SMART METER SMART GRID program by submitting legal briefs to the California Public Utilities Commission meetings and I testified at a California Public Utilities Commission hearing in San Clemente December 2012.

US Federal Communications Commission FCC Exposure Standards Maximum Permissible Exposure for the General Population of Uncontrolled Exposure to Wi-Fi Radiation in the frequency range of 1500 -100,000 MHz is ONE (1) mW/cm² for up to 30 minutes and Occupational controlled Exposure is FIVE (5) mW/cm² for up to 6 minutes. Please see page 47 of this Government Document.

http://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65b.pdf

The World Health Organization (WHO) has classified Wi-Fi as a Class 2B Carcinogen along with Lead, DDT, HIV, Methyl Mercury, Chloroform and Diesel Engine Exhaust.

<http://www.stopthecrime.net/docs/Medical-Advisory-WiFi-and-Children-06%20%281%29.pdf>
& http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

Designated substances

5.57 (1) If a substance identified as any of the following is present in the workplace, the employer must replace it, if practicable, with a material which reduces the risk to workers:

- (a) ACGIH A1 or A2, or IARC 1, 2A or 2B carcinogen;
- (b) ACGIH reproductive toxin;
- (c) ACGIH sensitizer;
- (d) ACGIH L endnote.

(2) If it is not practicable to substitute a material which reduces the risk to workers, in accordance with subsection (1), the employer must implement an exposure control plan to maintain workers' exposure as low as reasonably achievable below the exposure limit established under section 5.48.

(3) The exposure control plan must meet the requirements of section 5.54.

[en. B.C. Reg. 315/2003, App. A, s. 9; am. B.C. Reg. 258/2008, App. C, s. 2.]

Employers are required to address issues relating to Class 2B Carcinogens. I recommend that everyone turn off their cell phones during working hours.

I am electro-magnetic sensitive and I need refuge away from carcinogenic Wi-Fi radiation.

Electro- hypersensitivity (EHS) is a recognized and paid disability in Sweden.

http://iopscience.iop.org/1755-1315/10/1/012005/pdf/1755-1315_10_1_012005.pdf.

I also have documented some exposures at my daughter's school that would be ILLEGAL in Salzburg, Italy & Vienna. <http://www.powerwatch.org.uk/science/intguidance.asp> , see my youtube cannel. @ You Tube SarahParalegal Channel.

Electromagnetic Radiation is LETHAL over time.....People are reporting symptoms near cell towers and in proximity to other RFR-generating sources including consumer products such as wireless computer routers and Wi-Fi systems that appear to be classic "microwave sickness syndrome," also known as "radiofrequency radiation sickness." First identified in the 1950s by Soviet medical researchers, symptoms included headache, fatigue, ocular dysfunction, dizziness, and sleep disorders. In Soviet medicine, clinical manifestations include dermographism, tumors, blood changes, reproductive and cardiovascular abnormalities, depression, irritability, and

memory impairment, among others. The Soviet researchers noted that the syndrome is reversible in early stages but is considered lethal over time (Tolgskaya et al. 1973).

http://www.magdahavas.com/wordpress/wp-content/uploads/2010/11/Blake_Levit-Henry_Lai.pdf

[Electromagnetic-Radiation-Emitted-by-Cell-Tower-Base-Stations-and-Other-Antenna-Arrays-2010](#)

Firstenberg (Firstenberg, A, 2001, Radio Wave Packet, President, Cellular Phone Taskforce, http://www.goodhealthinfo.net/radiation/radio_wave_packet.pdf.)

Microwave radiation Lawsuits are multiplying. I support these smart meter lawsuits from concerned citizens who are fighting this Goliath defending God given rights to protect and defend privacy, safety, health and freedoms. <http://smartmeterlawsuits.blogspot.com/> &

<http://stopsmartmeters.org/2012/04/13/smart-meter-lawsuits-multiplying/>

The following documents outline the current case...

- [\[1\] Second Amended Complaint](#)
- [\[2\] Exhibits A and B to Second Amended Complaint](#)
- [\[3\] Amended Declaration of Dr David Carpenter](#)
- [\[4\] Declaration of Dr. Andrew Goldsworthy, Ph.D](#)
- [\[5\] Declaration of Dr. Magda Havas, Ph. D](#)
- [\[6\] Havas - Addendum A - Studies](#)
- [\[7\] Havas - Addendum B - Boston Petition](#)
- [\[8\] Havas - Addendum C - International Appeals](#)
- [\[9\] Havas - Addendum D - Presentation](#)
- [\[10\] Amended Declaration of Lloyd Morgan](#)
- [\[11\] Morgan - Addendum A - WI-FI Survey](#)
- [\[12\] Morgan - Addendum B - Mount Tabor Log Book](#)
- [\[14\] Morgan - Addendum D - BEMS presentation 6-12-08](#)
- [\[15\] Morgan - Addendum E - Poster - Re-evaluation of the Interphone Study](#)
- [\[16\] Morgan - Addendum F - Poster - Exposure Limits The underestimation . . . especially in children](#)
- [\[17\] Morgan - Addendum G - Poster - 108 How Many Brain Tumors v3 6-8-09 \[Compatibility Mode\]](#)
- [\[18\] Morgan - Addendum H - Poster - Incidence Rate Model 5-8-11](#)
- [\[19\] Morgan - Addendum I - Mobile Phone Use and Brain Tumors in Children and Adolescents](#)
- [\[20\] Amended Declaration of Barry Trower](#)
- [\[21\] Trower - Addendum A](#)
- [\[22\] Second Amended Declaration of Curtis Bennett](#)
- [\[23\] Expert Report of David Savitz \(Portland Public Schools\)](#)
- [\[24\] Reply of Dr David Carpenter, M.D.](#)
- [\[25\] Amended Reply of Dr. Magda Havas, Ph. D.](#)
- [\[26\] Amended Reply of L. Loyd Morgan](#)

- [Deposition of David Savitz](#)
- [L. Loyd Morgan Reply](#)
- [Reply of Dr David Carpenter, M.D.](#)

Radiation Sickness; Cynthia S Larson Comments, Feb. 4, 2013

FCC 12-152**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Notice of Proposed Rulemaking)	
18 FCC Rcd 13187, 13188 ¶1 (2003)	)	ET Docket No. 03-137
)	
And)	
)	
Service Rules for the Advanced Wireless Services	)	WT Docket No. 12-357
H Block---Implementing Section 6401 of the)	
Middle Class Tax Relief and Job Creation Act of)	
2012 Related to the 1915-1920 MHz and)	
1995-2000 MHz Bands ¶53 footnote 95)	

To: Office of the Secretary
Federal Communications Commission
Washington, DC 20554

Comment Filed by: Cynthia S. Larson
P.O. Box 7393
Berkeley, CA 94707-7393
cynthiaslarson@gmail.com
(510) 528-2044

February 2, 2013

AFFIDAVIT OF CYNTHIA S LARSON

State of CALIFORNIA]

Alameda County]

I, Cynthia S. Larson, attest that my statements are true to the best of my knowledge.

Comment round for ET Docket No. 03-137 and WT Docket No. 12-357.

1. My name is Cynthia S Larson. . My address is P.O. Box 7393, Berkeley, CA 94707-7393.
2. I am a self-employed writer with an AB degree in Physics from UC Berkeley and an MBA degree from San Francisco State University.
3. I have concerns that existing FCC RF safety guidelines and standards are inadequate to protect peoples' health, based on my direct experience with negative health effects from so-called "smart" meters including: dizziness, nosebleeds, blurred vision, ringing in my ears, migraine headaches and a generally foggy state of mind.
4. PG&E gas & electric smart meters were installed on my home in January 2010, as well as on homes to either side of mine, and all around my neighborhood.
5. One day in October 2011, I noticed I had become inexplicably and strangely unwell for weeks that dragged into months. I wondered why I awoke every morning feeling mentally dull (foggy), dizzy with a sense of vertigo, and with nosebleeds, blurred vision, ringing in my ears, and migraine headaches when nothing in my life or routine had changed. I had not experienced any of these symptoms on a daily basis before individually, let alone all together at once each and every day. I wondered why when I was sitting and reading a book, my heart would often skip a beat, and bizarre muscle tremors would inexplicably spasm across muscles on my face, arms, legs, and all over my body as if I'd just been given an invisible electric shock. When I spent ten days away from my home and away from smart meters in Maui in November 2011, I was amazed at how much better I felt. Gone were all the symptoms. When I returned home, all the aforementioned symptoms returned, and I wondered what was causing them. In January 2012, I caught strep throat and felt sicker than I'd ever been in my life. Unable to feel comfortable anywhere in the house—due to feeling such intense and inexplicable levels of pain in my head, eyes, ears, heart, and all over my body—I slept on the living room floor, and turned my full attention to the question of what, exactly, was making me feel so terribly sick.
6. In January 2012, I had an "Aha!" moment when I looked up my symptoms, I was amazed to find that many of them matched what used to be known as **"microwave sickness."** The first scientific report of microwave sickness appeared in 1974, with symptoms including: fatigue, headaches, palpitations, insomnia, skin symptoms, impotence and altered blood pressure. In cases of extreme exposure, symptoms also included: warming sensations, nausea, neuropathy (numbness, tingling, even paralysis in toes and fingers), stomach cramps, dyesthesia (a crushing sensation) and irritability. People in these studies had been accidentally exposed to microwave radiation, and no clear biological markers at that time were found, so these were not the kind of long-term studies that could establish safe exposure levels.

7. In January 2012 I called and wrote to PG&E, asking them to immediately remove and replace the smart meters that were making me so sick on my home with the analog meters I'd had for years, with no problems. The PG&E spokesman I reached on the phone read rather woodenly from some kind of prewritten script, repeating over and over again how "smart meters are harmless." I explained to him that I have a degree in physics from UC Berkeley, and am well aware that many kinds of radiation that we currently don't have health standards or studies for are far from harmless, and that I was certain I am experiencing extremely negative effects from smart meters installed on my home. Eventually, this so-called "help" line staffer informed me that there was nothing I could do—there was no way (yet) to opt out.
8. During the months of October 2011 through February 2012 my cognitive abilities were profoundly impacted and I became severely depressed due to migraines, heart palpitations, nosebleeds and lack of sleep. This adversely impacted my ability to earn a living since I am self-employed, and do not get sick time.
9. At the beginning of February 2012, I requested a smart meter opt-out from my local utility company, Pacific Gas & Electric (PG&E), on the very first day they offered such a program to the public, and exactly one week later on February 8, 2012, the gas and electric smart meters on my home were replaced with analog meters. While I still hear ringing in my ears and have increased sensitivity to my computer that I never had before, I'm now sleeping well and no longer waking up with nosebleeds and migraine headaches... and the heart palpitations, muscle spasms and blurred vision are a thing of the past.
10. Since smart meters were installed on my house, I have become increasingly RF sensitive. Prolonged exposure to my Mac laptop computer when it's using WiFi makes whatever parts of my body are closest to it vibrate and buzz uncomfortably. On days when I travel on public transportation, such as the bus or Bay Area Rapid Transit (BART), I come down with a cold for several days immediately afterward—and I never before in my life had such a reaction to being on public transportation back in the days before cell phones were in most people's pockets.

Respectfully submitted by

Cynthia S. Larson
P.O. Box 7393
Berkeley, CA 94707-7393
February 2, 2013

Radiation Sickness; Josh Fisher Comments, Oct. 3, 2016

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Proceedings GN 14-177 ET 13-84
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Brief Comment

over the last year my family has become aware that we have electromagnetic hypersensitivity. we have had to scrub our home of EMFs and all forms of wireless communication (wifi, cordless phone, Bluetooth, cell phones). wireless and emf are toxins that cause immune activation and other problems with prolonged or abnormal exposure (wifi is on 24/7). some of the symptoms include migraines or headaches, fever, flushing of face, chronic inflammation, brain inflammation (leading to ADD, dementia, confusion), poor situational awareness, chronic fatigue, poor depth perception, sensation of unreality, irritable bowel syndrome, aching joints and muscles, and muscle spasms or tremors. after knowing about this problem for only one year, using an EMF meter and RF meter, I have been able to help a number of others realize what is causing their health problems as well. higher frequency wireless transmissions require a lot more power to cover the same distance as lower frequencies. if you fast track this process without looking into the health problems they will cause electromagnetic hypersensitivity will become a household term and the major epidemic of our time.

Radiation Sickness; Paul Stanley (Petitioner) Comments, Oct. 3, 2016

September 30, 2106

Aloha FCC,

I have been a Hawaii public school teacher since 1989 and a school technologist since 1992.

Since 2001 I have been suffering from an illness that the World Health Organization (WHO) calls Electromagnetic Hypersensitivity (EHS). This was caused by over exposure to microwaves (cell phone repeaters on the roof of my working place and wi-fi).

My symptoms include: a burning sensation in my head that continues and increases until I can move away from the source, a terrible sensation of pain through out the body, muscle spasms, irritability, insomnia, confusion, inability to concentrate and others. This all translates to stress on the body which can lead to a whole host of other ailments.

Radio waves are the ultimate pollutant. You can't see, hear, smell them, but contrary to what the "experts" say your body is stressed by them. Unfortunately for me, over exposure has left me with Electromagnetic Hypersensitivity (EHS).

The truth is that the FCC "safety" standards are obsolete and the evidence is that myself and others got sick.

There are many others in Hawaii that are suffering from this debilitating condition.

I've had EHS since 2004. I lost my dream job in educational television that I worked so hard to get. This job that I loved exposed me to microwave signals daily for six years until my body broke down and I had to quit. The many cell phone antennas and microwave transmission dishes on the roof above my office pushed me beyond my body's limits.

This was just the beginning of a very long, living nightmare. The damage had been done. I could not even sleep in my own home because of my neighbors' wi-fi signals coming into my home. After twelve years, I still am injured by Electro Magnetic Radiation (EMR).

I lost my job, had to sell my home and I've spent more than \$60,000.00 seeking treatment to heal this affliction. I've spent my life savings and have no money for my children's college education.

If 5G networks are implemented, my life will be even more impossible with antennas everywhere. I ask that it will be stopped until further investigation as to the harms that it creates.

Thank you,
Paul Stanley, M.Ed. (Educational Technology)
Apple Distinguished Educator
PO Box 894821
Mililani, HI 96789

Radiation Sickness; Lynnell Rosser Letter, Nov. 25, 2013

Lynnell Rosser, Box 644, Sonita AZ 85637

NOV 25 2013

FCC Radiofrequency Reassessment

ET Docket No. 03-137 and ET Docket No. 13-84

FCC Mail Room

Six years ago my family bought a house that was in the city of Mesa Arizona. I started to have nervousness & could not relax. I could not sleep. I had migraine headaches, severe fatigue, my skin (nerves) were stinging (burning sensation) chest tightness which is very scary. I could not tolerate the house. I called in a specialists who tests homes for toxins that may be making them sick in the home. After looking around the area and testing my home he said that the microwave radiation in the house was very high. He pointed out that we have 3 cell phone antennas very close at the high school we can see clearly out out back window.

We have 291 registered cell phone antennas in a four mile radius of our home. Through his findings and process of elimination and experimentation I know for a fact that this over exposure to microwaves was causing my health problems. Through this over exposure I had been become electrically hypersensitive.

I put RF blocking material on all the windows at a very high cost to us. It cut the radiation down so I could tolerate the house but was severely fatigued. I could not sleep in the house however and had to travel seven miles to a gated park to sleep in my van.

Then August of 2011 I started to feel the electrical stress more intensely. Something had changed. My nerves were burning. I started to search for answers and found out that two smart phones had been released and that the antennas had been converted to 4G strength. I experimented to make sure. I would get closer to the antennas at the high school and my symptoms were intensified. When I went to a remote area my symptoms were gone.

I worked all my life to afford a nice home that was mortgage free and I can't live in it. I have been moving from place to place but 4G conversion takes place and I am homeless again. There is no microwave free air for people to get refuge.

These pulsing microwaves are dangerous and deadly. I have children but have to live far from them to protect myself. It has broken up my marriage of which was happy before this all occurred. So I am all alone and secluded in a remote area because of the cell industry. Who knows how long I will be safe where I am and have to flee. And to where?

With little money and disabled what are people like me going to do? The children's developing bodies, nervous systems, are going to be damaged. This is an invisible monster no one will acknowledge due to enormous amount of money it makes.

The cost of gas to escape this exposure and extra living expenses and blocking materials is too much to bare. Most cannot afford it and thus are killing themselves.

Please restrict heavily this 4G radiation. Take them away from schools and residential areas.

If not we will have a world full of disabled people that can't work and cannot pay taxes. Where will the economy be then? Many are committing suicide because they have no money and no where to go. It is shear torture. Lynnell Rosser

Email 10i326@yahoo.com

Lynnell Rosser

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Radiation Sickness; Charyl Zehfus Reply Comments, Sep. 12, 2016

FCC 13-39

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of

Reassessment of Federal Communications
Commission Radiofrequency Exposure Limits and
Policies

Proposed Changes in the Commission's Rules
Regarding Human Exposure to Radiofrequency
Electromagnetic Fields

ET Docket No. 13-84

ET Docket No. 03-137

To: Office of the Secretary
Federal Communications Commission
Washington, DC 20554

Reply Filed by:

Charyl Zehfus
N6158 N. 61st Street
Sheboygan, WI 53083
szeefas@yahoo.com
920-467-4853

September 12, 2013

AFFIDAVIT OF Charyl Zehfus

State of Wisconsin

Sheboygan County

I, Charyl Zehfus _____, attest that my statements are true to the best of my knowledge.

Reply round for FCC ET Docket No. 013-84 and ET Docket No. 03-137

1. My name is _Charyl Zehfus_. My address is _N6158 N. 61st Street, Sheboygan, WI 53083_____.

2. I am retired librarian, and an active researcher/writer.

3. I am re-submitting the following slightly updated comments as an affidavit to the FCC Commissioner about the dire need to involve the EPA towards lowering U.S. radiofrequency/microwave (RF/MW) limits to biologically-based standards, and to undertake a full NEPA evaluation as a legal necessity due to reported injuries from RF/MW allowed emissions. (The documents listed were already uploaded and can be accessed in my earlier submission.)

4. The current FCC proceeding legally requires a NEPA assessment due to reports of injury traceable to RF/MW exposure occurring under existing guidelines, which establishing biologically-based RF safety limits would prevent. The description of this legal necessity for a NEPA follows: Under NEPA, "federal officials are required to assume the responsibility that the Congress recognized . . . as the obligation of all citizens: to incorporate the consideration of environmental factors into the [federal] decision-making process." *Env'tl. Def. Fund v. Tenn. Valley Auth.*, 468 F.2d 1164, 1174 (6th Cir. 1972). Officials comply with NEPA "primarily by [conducting] an [EIS] for any 'major Federal action significantly affecting the quality of the human environment.'" *Burkholder v. Peters*, 58 F. App'x 94, 96 (6th Cir. 2003) (quoting 42 U.S.C. § 4332(2)(C)). [Ref. - <http://www.ca6.uscourts.gov/opinions.pdf/10a0374p-06.pdf> Per No. 09-5761 Heartwood, Inc., et al. v. Agpaoa, et al. there is standing to challenge the current exposure guidelines because you have suffered an 'injury in fact' that is concrete and particularized; is actual or imminent; is traceable to wireless exposure; and that it is likely that this injury will be redressed by lower exposure guidelines.]

5. The Federal Communications Commission must include provisions for people with disabilities by law. Electromagnetic Sensitivity (EMS) was first recognized by U.S. federal law in 2002 by the U.S. Access Board, as a functional impairment disability covered by the Americans with Disabilities Act (ADA), as follows:

"The Board recognizes that multiple chemical sensitivities and electromagnetic sensitivities may be considered disabilities under the ADA if they so severely impair

6. At least 3% of the population has EMS, as cited in the 2005 "IEQ Indoor Environmental Quality" National Institute of Building Sciences report, which was supported by the Access Board.² I am one of the 3%. During the expansion of wireless radiation sources I developed severe EMS. Exposure to RF/MW continues to impair my sleep, joint and muscle functions, concentration/thinking and breathing. Due to impairment from RF emissions from various sources I must substantially limit time spent in places other people can go, such as school events, club meetings, etc. I cannot use public transportation due to WiFi and cell phones. These details (and others) regarding my impairment would satisfy the criteria for defining a disability, according to the ADA Amendment Act of 2008, Section 3. Definition of Disability.³

7. An important agency that officially recognizes the health risks of being exposed to electromagnetic fields is Health and Human Service on their web page about Shelter-in-place, medical emergency planning (webpage attached). Here is what they say:

"Stress the need to prepare for severe medical needs. Individuals and care facilities should collect supplies based on the greatest possible level of need. **Disaster conditions may trigger health reactions that are stronger than normal.** Smoke, dust, molds, gas leaks, diesel from idling rescue vehicles, flashing lights, **radio waves, electromagnetic fields (from generators, emergency lights, cellular phones, walkie-talkies), and airborne toxins may worsen disabilities related to medical needs.** Those with medical needs should prepare for more needs than they usually have. To do so, they should keep the following accessible at all times:

- **A health information card that explains sensitivities**, reactions, treatments that work, and treatments that are harmful..."

Clearly EMF and radio waves are not benign if they are listed as potentially irritating or noxious exposures for disabled people in emergencies.⁴

8. Any cost-benefit figures must include 9.5 million people's loss of daily function due to lack of biologically based RF exposure guidelines, the financial hardship for families from many doctor visits, medicines, supplements, the lack of ability to work and gain income, lack of ability to go places to purchase products or recreate. The sum total of mobility loss, employment loss, social connection loss, medical expenses and incalculable suffering would be nonexistent if only protective biological standards for wireless radiation limits were put in place. In short, FCC's lack of protective RF limits is ruining lives and costing families and society on numerous fronts, yet to be fully realized.

9. Reasonable accommodations for EMS, according to the U.S. Access Board in 2005, include turning off cell phones, turning off or unplugging computers and other electrical equipment, and turning off fluorescent lighting in the public buildings.⁵ Likewise, EMS people should be allowed to have non-transmitting analog utility meters on their homes and properties without penalties AT THE VERY LEAST. Additional accommodations for EMS would depend upon the location and situation. The FCC rules ought to include provisions for persons suffering this recognized impairment.

10. I hope the Commission will realize that because a product or device is legally made and sold does not mean it is safe for every person. Please compare this to peanut or latex allergy. Even small amounts of certain environmental agents are neither tolerable nor safe for some individuals.

11. The FCC is entrusted to adhere to existing federal laws in creating policies that affect the entire public. The federal ADA legally requires reasonable accommodation of people with disabilities, including EMS, as recognized by other governmental agencies/branches. Please pursue having a NEPA done by the EPA in light of this serious omission in current law, and addressing the needs of this disabled minority in any updates of RF/MW limits.

Thank you for your time and careful consideration of the FCC's responsibility to include all Americans in its policy plans, including the disabled and other vulnerable groups who need special consideration and protection.

Respectfully submitted,

Charyl Zehfus
N6158 N. 61st Street
Sheboygan, WI 53083
(920)467-4853

P.S. To help the Commission understand there is scientific and medical basis for getting the EPA to do a comprehensive environmental evaluation, please see the following sample of studies finding some people to have electromagnetic sensitivity and concluding that non-thermal radiofrequency and microwave (RF/MW) radiation exposures can have biological effects.

*Amy L. Dean, DO, FAAEM, DABEM, DAOBIM, President, American Academy of Environmental Medicine, Letter to Federal Communications Commission Commissioners, August 27, 2013, RE: ET Docket 13-84. "Founded in 1965 as a non-profit medical association, the AAEM is an international association of physicians and scientists who study and treat the effects of the environment on human health...In the last five years with the advent of wireless devices, there has been an exponential increase in the number of patients with radiofrequency induced disease and hypersensitivity..." (Letter attached)

*2012 BioInitiative Report contains over 1,800 scientific studies done in the previous five years showing biological effects of RF/MW (non-thermal), published by 29 highly respected health professionals from ten countries. The report concluded 'a growing number of people worldwide have serious and debilitating symptoms that are key to various types of EMF and RFR exposure. Of this there is little doubt.' <http://www.bioinitiative.org/conclusions/>

*David E. McCarty, Simona Carrubba, et al., "Electromagnetic Hypersensitivity: Evidence for a Novel Neurological Syndrome," *International Journal of Neuroscience*, December 2011, Vol. 121, No. 12, Pages 670-676. "The subject demonstrated statistically reliable somatic reactions in response to exposure to subliminal EMFs under conditions that reasonably excluded a causative role for psychological processes. *Conclusion*: EMF hypersensitivity can occur as a *bona fide* environmentally inducible neurological syndrome." <http://informahealthcare.com/doi/abs/10.3109/00207454.2011.608139>

*William J. Rea, MD, FACS, "Electromagnetic Field Sensitivity," 1991, *Journal of Bioelectricity*, 10(1&2, 241-256. "We concluded that this study gives strong evidence that electromagnetic field sensitivity exists, and can be elicited under environmentally controlled conditions." http://www.aehf.com/articles/em_sensitive.html

Endnotes:

1 Architectural and Transportation Barriers Compliance Board, "Americans With Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Recreation Facilities." Federal Register, Vol. 67, No. 170, September 3, 2002, Rules and Regulations, pages 56352-56353. <http://www.gpo.gov/fdsys/pkg/FR-2002-09-03/html/02-21805.htm>

2 National Institute of Building Sciences (NIBS) with funding support from The Architectural and Transportation Barriers Compliance Board (Access Board), "IEQ Indoor Environmental Quality," 2005, page 4. (Document attached).

3 ADA Amendment Act of 2008, Sec. 3, Definition of Disability (Document attached).

4 Health and Human Service web page, Shelter-in-place, medical emergency planning (This document was not previously attached, so will be here)

5 National Institute of Building Sciences (NIBS) with funding support from The Architectural and Transportation Barriers Compliance Board (Access Board), "IEQ Indoor Environmental Quality," 2005, page 52. (Document attached).

Respectfully submitted by

Charyl Zehfus

N6158 N. 61st Street

Sheboygan, WI 53083

September 12, 2013

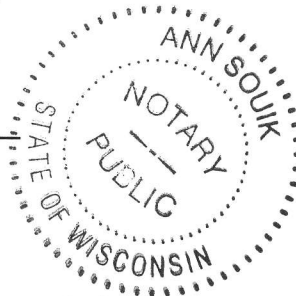
Charyl Zehfus

(your signature)

Sworn to before me

This 12 day of September (month) 2013

Ann Souik
Notary Public



10/9/10

Radiation Sickness; Annie Starr Comments, Sep. 4, 2013

(Submission 2 - 1st submission was missing some of this information)I am writing to tell you that the current rf radiation exposure limits are very high and should be completely lowered. I have been injured by rf radiation that complies with the current exposure limits. These limits do not right now account for biological needs and responses. Cell phone towers should not be put on private dwellings, hospitals or nursing homes, or schools. The landline switched telephone network must be maintained. Smart meters should not be mandated nationally. There is too much radiation being emitted.

I have been very ill from exposure to the cell phone antennas (base station) on my roof for many years. It changed my life and made me disabled in many ways especially making it hard if not impossible to participate in many activities where there are cell phone antennas, which is basically now almost everywhere, especially if they are directly on the roof of the building I may be in. I never used to have such a reaction. But after the base station and bars were put on my building I became more and more sensitive to these towers -- 1st on my own building where I had problems and reactions everytime I was at my home (which abated when I left home), and then noticing and responding to towers on many buildings around me where ever I was walking or going.

I also became sensitive to cell phones, many wireless products such as computers and also many electrical appliances.

When cell phone towers were turned on on my roof, we could immediately feel a magnetic pull, as if something was literally pulling or drawing us and it was toward the direction of one of the antennas on one side of the apt. We could feel also something emitting like waves of heat from the direction of the base station hut on the opposite side of the apt. We had to open all the windows thought it was a cold snowy winter night in December. We could feel many small shocks all over the body, and hear a high pitched frequency which never ceased. I think that when the tower was turned on that was initially when I became very injured from the immediate impact of such a high exposure suddenly which harmed my own human personal magnetic field. Gaus meters would show we were in the red zone on the meter all the time. Sometimes there were several frequencies and pitches overlapping. I was in extreme pain, suffered a seizure, and had female bleeding for many weeks. Those living with me also heard constantly an undercurrent of noise and high pitches. I had to seek refuge at a friend's house where I had to lie down for several days on the floor. I could not sit because the room would appear to spin and I felt I was turning incessantly. I felt everything was spinning as if there was no magnetic pole to hold on to. I held on to the legs of a chair in order to feel that I could hold on to something. I also felt as if I had been nuked - no other way to describe it exactly -- as if when one is out in the sun too long and gets some sun poisoning and is hot and nauseous-- except I had not been in the sun at all and this was in the middle of December winter. This is from too much emf exposure. I had to leave my home for several months. Burn marks on my skin near the pelvic area appeared and have continued and grown larger over many years. Being exposed for so many years to too much rf radiation often causes me to become dizzy, to lose my physical balance, to feel the room is spinning, sometimes to have to sit or lie down on the floor to make the spinning stop, often to feel nauseous, and

to be extremely hot on the skin. These are symptoms of radiation illness. It also interferes with sleeping. I am awakened by the noise from the antennas- the high pitches which are on sometimes much louder than other times. It interferes with my hearing much of the time. Blood pressure has gone up sky high, with heart palpitations and migraines. The frequencies especially affect the heart beat making it beat very fast. A pain in the back of the head near the occipital ridge often recurs with a feeling of a constant beat or pulse being very prominent for many years. In my home also all the pets suffered catastrophic illnesses with unusual and enlarged tumors of cancer from which they died.

The exposure of rf from the towers also made me become very sensitive to cell phones. I rarely ever used a cell phone. The first time I ever used a cell phone was in 1999 when I borrowed a phone to ask for directions and spoke one or two minutes. Afterwards I rarely used a cell phone nor did any of my colleagues. I have never owned a cell phone and never had any regular use at all of a cell phone. My symptoms did not come from a phone but from the antennas which sensitized me to the frequencies and to the phones. I cannot use a phone on my own ear and am sensitive to people using cell phones around me. I feel sharp burning pains when the phones are near me. It is very difficult to be where people always use cell phones, which at this point is almost everywhere, for example in public transportation, or religious meetings, theatres or almost anywhere that people gather, or in offices or classes. If someone holds a cell phone behind my head for example on a crowded bus I will feel burning pain -- like extreme hot fire in my head which will last for several hours. I rarely ever used a cell phone. In 1999 a friend had one and used it sparingly. I did not hear any high pitches or frequencies and did not have any responses to the phone. But I became more and more sensitive to them. I cannot use a cell phone for any long time. If I do use one even for a minute, I have immediate and long lasting reactions to it with burning in my ears and redness and burn marks on my skin and long term pain and interference with hearing. It is after the tower was placed on my building that I began to hear these frequencies and respond to them and with each passing year I became more and more sensitive to emf radiation because of the constant exposure in my home all around me. I have developed this sensitivity to cell phones, computers and many electrical appliances. This is electromagnetic hypersensitivity. I cannot use a cell phone for daily and or regular communication. There is at least 3% of the population who have the same difficulty. (about 10 million people). (That is those that are known).

It is hard to reveal these personal issues but it is paramount to inform you, those who would change the system of phones. I want to be able to communicate with people. If I have to use a cell phone I will not be able to communicate with others in any regular way. I want to be able to communicate and enjoy the freedom of our wonderful democracy here to choose the type of voice phone I need. It is of utmost importance to maintain the switched telephone network. I do not stop people from using their cell phones. Please do not stop me from using my land line.

Electro magnetic sensitivity makes it also very difficult to be near medical machines or in an ER facility. A medical protocol is needed for magnetic hypersensitive people using more analog machines and rooms where there are no cell phones or many wireless devices.

After all these years there still is no recognition of magnetic electrical sensitivity as a disability. It is necessary to train doctors who recognize radiation illness and sensitivity to emf and rf radiation. We also need radio free zones throughout the country.

RF radiation is very dangerous and is also affecting the pollinators - the bees and butterflies and other beneficial insects who are too sensitive to the frequencies, and radiation. These pollinators help our food chain. If we have no pollinators we will not have food. The radiation of the towers and constant increase of frequencies and all of the radiation we are being emmersed in from the towers, smart meters and wireless devices, is causing health problems and the endangerment of our food for the world!

This must be curtailed and a return to many analog devices be made. The wireless radiation is causing U.S. and worldwide, health problems, cancer, genetic changes in all life forms and contributing to the global warming and terrible weather conditions of storms.

Smart meters should not be made mandatory nationwide. Many people already are experiencing problems from them with so much radiation being placed directly on their homes. It makes appliances buzz and transfers the radiation through the wiring into the home. It has caused heart attacks. It has made people leave their homes. There have been many incidents where the meters arc electrically and cause fires and explosions. They are causing cancer and tumors.

Smart meters are also the nail in the coffin for the bees and other pollinators. The meters are emitting too much radiation and they cannot withstand it and are dying. We need our pollinators for food. The current radiation exposure limits are much too high and are affecting all life on this planet negatively. These limits must be completely lowered now. Thank you for your attention.

Radiation Sickness; Rob Bland Comments, Sep. 3, 2013

I am hypersensitivity to Wireless or RF, and with all the mounting evidence which indicates health issues from wireless sources I urge the FCC to do what's right reevaluate their standards which haven't be reviewed since 1996. Surly with the increase of electro-smog in our atmosphere, it's time to reexamine what should be allowed.

I have medical documentation which correlates to this health concern I've raised and will be pursuing litigation further in order to bring to light this gross injustice.

Regards,
Rob Bland

Radiation Sickness; Nancy Rose Gerler Comments, Sep. 3, 2013

Comments on Notice of Inquiry, ET Docket No. 13-84

To All This Does Concern

I am submitting this testimonial to request a close look at the damage that radiation over-exposure at current limits has caused me, and many others who already are categorized as electro-hyper-sensitive people. It has impacted every area of my life, and I am no longer able to have a normal life, where I can go anywhere in town. The over-assault of micro-wave radiation emitting devices currently at use in our culture is already at a literal state of over-kill. Like the proverbial canary in the coal mine, I feel the effects of this assault on our bodies, invisibly destroying cells down to the DNA. This “electro-smog” pollution poses a deadly threat to all.

Since the advent of commercial and residential microwave ovens that became present in the 1970’s, I found I could not be in the same room as a microwave when turned on. I felt a strange sensation in my flesh, down to my bones that caused me to flee to safety outside, or in a garage – anywhere I could get away.

Flash forward to present day. The installation of the new wireless “Smart Meters” measuring electrical consumption began in my hometown and I began experiencing what I now recognize as classic symptoms of electro hypersensitivity:

1. Headaches of unknown origin, long duration, resistant to pain killers.
2. Ringing in the ears that increases in volume and pitch when I’m near cell towers, antennas, wireless routers. It is annoying and at times almost deafening when I’ve inadvertently had high exposure.
3. Insomnia, restless sleep, often as little as 3-4 hours at night.
4. Nausea, queasy nervous stomach, but little or no appetite.
5. Heart palpitations, rapid heart increase for no apparent reason, and no personal history of heart problems.
6. Neurological symptoms – muscle spasms, twitches, tremors, etc.
7. Anxious, agitated emotional affect for no reason or strong urge to flee location, especially if it’s WI-FI, which is everywhere.

The list goes on and on.

I now know my often ill health was caused due to excessive exposure to microwave radiation due to the business location of my office in an epicenter of radiation. I was forced to vacate immediately when EMF and stetzer meters proved the office unsafe for me.

My life is now limited to the least exposure to the outside world. The multitude of “smart meters,” WIFI routers, cell towers and antennas, all other emitting systems and devices have made the life I loved, and city I love a nightmare for me. I struggle to maintain my health in a home that has been mitigated, at some expense to be safe for me.

Please look at the real science, not the pseudo-science backed by a self-serving industry. Reduce acceptable radiation levels and create EMF free zones.

Sincerely,

Nanci Rose Gerler

PS. I have been looking for a new place to live to escape the assault of EMF in this vicinity for several months, thus far to no avail. I must be away from towers and high tension wires by approximately four miles, and no wireless routers/wifi used nearby and no “smart meters” on the home or area. For me this literally a matter of survival.

Radiation Sickness; Monnie Ramsell Comments, Feb. 5, 2013

FCC 12-152

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Notice of Proposed Rulemaking)	
18 FCC Rcd 13187, 13188 ¶1 (2003)	)	ET Docket No. 03-137
)	
And)	
)	
Service Rules for the Advanced Wireless Services	)	WT Docket No. 12-357
H Block---Implementing Section 6401 of the)	
Middle Class Tax Relief and Job Creation Act of)	
2012 Related to the 1915-1920 MHz and)	
1995-2000 MHz Bands ¶53 footnote 95)	

To: Office of the Secretary
Federal Communications Commission
Washington, DC 20554

Comment Filed by: Monnie Ramsell
50 Bronco Drive
Sedona, AZ 86336
monnie@ramsell.net
928-282-6318

February 5, 2013

AFFIDAVIT OF

State of Arizona]

Yavapai County]

I, Monnie Ramsell, attest that my statements are true to the best of my knowledge.

Comment round for ET Docket No. 03-137 and WT Docket No. 12-357.

My name is Monnie Ramsell. My address is 50 Bronco Drive, Sedona, AZ 86336.

I am a business owner for over fifteen years and I have a Masters Degree in Business Administration. We were aware of the issues of EMF and RF when we had interference with our computer monitors in our offices when their location were within a few feet of any electric panel. There were flickering and distortions on the monitor screen from the radiation coming out of the electrical panel. We had to shield the electric panel. We had to take great care for the placement of computers and other sensitive electronics to minimize these interferences.

Personally I have also experience sensitivity in form of headaches, loss of words when using cordless phone or cell phone held against my head. My business phone is now a regular phone on the landline. I also experience headache when I am underneath a plasma screen. I have taken great precaution to minimize my exposure to EMF and RF. If EMF and RF's frequencies could play havoc to electronics, it certain had an effect on all living beings because we are electrical beings. Our brain activities, the firing or neurons and the beating of the heart valves are all electrical activities. Businesses spend lots of money to protect their data. We all know too well that solar flares or electromagnetic storms can affect satellite and cell phone. We know too well of static electricity can wipe out data from our computer hard drives. Our cells are very delicate and are affected by non-thermal low dose of RF and EMF similar to the sensitive data on

our hard drive. The frequencies of these RF signals are not conducive to life. The military knew all about it.

I have come across a letter written by Norbet Hankin, Radiation Protection Division of the United States Environmental Protection Agency replying to Janet Newton, President of The EMR Network on March 8, 2002. In the letter, Mr. Hankin addressed Ms. Newton's concerns about non-thermal effects of radiofrequency (RF) radiation and the adequacy of the Federal Communications Commission's RF radiation exposure guidelines. The Administrator had asked the EPA to critically examine issues of possible health risks, and Federal government's responsibility to protect human health.

In the letter to Ms. Newton, Mr. Hankin stated that the guidelines currently used by the FCC were adopted by the FCC in 1996. The guidelines were recommended by EPA, with certain reservations, in a letter to Thomas P. Stanley, Chief Engineer, Office of Engineering and Technology, Federal Communications Commissions, November 9, 1993, in response to the FCC's request for comments on their Notice of Proposed Rulemaking (NPRM), Guidelines for Evaluation the Environmental Effects of Radiofrequency Radiation.

The FCC's current exposure guidelines, as well as those of the Institute of Electrical and Electronics Engineers (IEEE) and the International Commission on Non-ionizing Radiation Protection, are thermally based, and do not apply to CHRONIC, NONTHERMAL exposure situations. They are believed to protect against injury that may be caused by ACUTE exposures that result in tissue heating or electric shock and burn. The hazard level (for frequencies generally at or greater than 3 MHz) is based on a specific absorption dose-rate, SAR associated with an effect that results from an increase in body temperature. The FCC's exposure guideline is considered protective of effects arising from a thermal mechanism but not from ALL POSSIBLE mechanisms. Therefore, the generalization by many that the guidelines protect human beings from harm by any or all mechanisms IS NOT JUSTIFIED.

These guidelines are based on findings of an adverse effect level of 4 watts per kilogram (W/kg) body weight. This SAR was observed in laboratory research involving acute exposures that elevated body temperature of animals including nonhuman primates. The exposure guidelines DID NOT CONSIDER information that addresses NONTHERMAL, PROLONGED exposures, i.e., from research showing effects with implications for possible adversity in situations involving chronic/prolonged, low-level (nonthermal) exposures. Relatively few chronic, low-level exposure studies of laboratory animals and epidemiological studies of human populations have been reported at the time the letter was written. Since then, there are reports that suggest that potentially adverse health effects, such as cancer, may occur. Since EPS's comments were submitted to the FCC in 1993, the number of studies reporting effects associated with both acute and chronic low-level exposure to RF radiation has increased.

The FCC does not claim that their exposure guidelines provide protection for exposures to which the 4 W/kg SAR basis does not apply, i.e. exposures below the 4W/kg threshold level that are chronic/prolonged and nonthermal. In fact, there have been many studies showing that low level exposure way below the FCC guidelines have detrimental effects. Level of nonthermal RF exposure way below the FCC guidelines have shown to damage the fetal brain, make cells leaky, adversely affect the heart rhythm, damage sperm, break DNA strands and damage DNA, increase glucose in the brain, affect our immune system, cause neurological damage, cause memory loss, etc. In fact, on May 31, 2011, the World Health Organization (WHO) had classified RF as Class 2B Carcinogen, same class as lead, asbestos, engine exhaust, DDT and Agent Orange.

The 4W/kg SAR, a whole-body average, time-average dose-rate, is used to derive dose-rate and exposure limits for situations involving RF radiation exposure of a person's entire body from a relatively remote radiation source. Most people's greatest exposures result from the use of personal communications devices that expose the head. In summary, the current exposure guidelines used by the FCC as based on the effects resulting from whole-body heating, not exposure of and effect on critical organs including the brain and the eyes. In addition, the maximum permitted local SAR limit of 1.6 @/kg for critical

organs of the body is related directly to the permitted whole body average SAR (0.08 W/kg), with no explanation given other than to limit heating.

Federal health and safety agencies have not yet developed policies concerning possible risk from long-term, nonthermal exposures. When developing exposing standards for other physical agents such as toxic substances, health risk uncertainties, with emphasis given to sensitive populations, are often considered. Young children in school with WiFi, the elderly, the sick are among this group of sensitive populations. And the latest assault is smart meters installed in every single home, schools and even hospitals. Incorporating information on exposure scenarios involving repeated short duration/nonthermal exposures that may continue over very long periods of time (years), with an exposed population that includes children, the elderly, pregnant women and people with various debilitating physical and medical conditions, is necessary in delineating appropriate protective exposure guidelines.

The FCC guidelines are outdated and not adequate to protect any public health and safety and needed to be revised as soon as possible.

Respectfully submitted by

Monnie Ramsell
50 Bronco Drive
Sedona, AZ 86336
February 5, 2013

Radiation Sickness; Miriam D. Weber Comments, Sept 3, 2013

Comments for FCC ET Docket No. 13-84 and ET Docket No. 03-137

1. My name is Miriam D Weber and my mailing address is PO Box 1161, Tucson, AZ 85702. I am a resident of Tucson, AZ.

I am a practicing physician and a licensed acupuncturist.

2. In 2011, The World Health Organization classified radio frequency radiation as a possible human carcinogen (Class 2B). Two years later, the US Institute of Health and the FCC and the FDA have yet to update their positions on the potential health effects of radio frequency radiation.

The 2012 BioInitiative Report is incorporated by reference herein in its entirety

(<http://www.bioinitiative.org>)

3. I regularly deal with patients and community members who have become electrically hypersensitive, some of whom have been forced to radically alter their living and work spaces as well as their habits in order to avoid debilitating symptoms caused by exposure to radio frequency radiation emitted by utility meters and cell towers. The US Department of Education is actively promoting the extension of wireless enabled technologies into school classrooms, and the US Department of Energy is funding smart grid grants with the target of installing microwave emitting smart wireless utility meters on every building in the US by 2020. I am deeply concerned that there is no federal agency evaluating public health risks, or reports of harm, associated with an increasing environmental exposure to radio frequency radiation found in the workplace, in public spaces, in schools and in our homes.

Compliance with FCC radiofrequency radiation limits is often cited as an excuse to ignore evidence of harm by transmitting utility meters...etc and to force harmful exposure on people against their will. When Southwest Gas installed their radio frequency transmitting meter on my home in the summer of 2008, a year later I requested its removal and the reinstallation of the old meter. I asked for this because of the uncontrollable hypertension I experienced after the new radio frequency transmitting meter was installed. I was told by SW Gas that the FCC had determined that I would not be harmed by the operation of the new meter. Five years later, I am still dealing with uncontrolled hypertension as well as an array of other symptoms that are greatly aggravated when I spend more than a half hour in my kitchen, the room adjacent to the new meter.

The FCC is causing substantial harm to citizens by not updating RF exposure limits to biologically-based safety limits.

4. Due to an increased consumer demand, new wireless devices for personal use are rapidly multiplying, accompanied by greater signal strength, increased band width and higher levels of background radiation from a growing number of cell towers located in

urban settings. There are no human studies that assess the existence or nonexistence of potentially increased rates of morbidity and mortality that might be associated with this surge of ambient radio frequency radiation.

The current FCC guidelines regulate short-term exposure to radio frequency radiation and they do not take in to account actual real life exposure. This includes hours of cell phone use and the existence of many radio frequency transmitting towers in or very close to residential neighborhoods. When the FCC instituted its 1997 guidelines, the negative biological effect of radio frequency radiation was defined as a thermal-level exposure capable of causing burns and tissue heating. Since that time, an increasing number of studies show other harmful non-thermal biological effects caused by various levels of radio frequency radiation that are much lower than the current allowable levels.

“Public safety standards are 1,000 – 10,000 or more times higher than levels now commonly reported in mobile phone base station studies to cause bioeffects.”(<http://www.bioinitiative.org/conclusions/>

5. The FCC does not possess the expertise to set biologically-based radiofrequency radiation safety limits. EPA does. Therefore, the FCC should advocate that Congress direct the EPA to establish biologically-based radiofrequency radiation safety limits and provide the budget and resources to carry out that task.

The FCC has a duty under *Scenic Hudson v. Federal Power Commission* to create a complete record and to consider seriously public comments in order to fulfill its obligation to represent the public interest. The FCC should make a direct request to the EPA to use its taxpayer-funded resources and experts present at its National Risk Management Research Laboratory to conduct all of the cost analyses it has asked for in this proceeding.

This proceeding requires a NEPA assessment due to reports of injury traceable to radiofrequency exposure under existing guidelines, which establishing biologically-based RF safety limits would prevent. Under NEPA, “federal officials are required to assume the responsibility that the Congress recognized . . . as the obligation of all citizens: to incorporate the consideration of environmental factors into the [federal] decision-making process.” *Envtl. Def. Fund v. Tenn. Valley Auth.*, 468 F.2d 1164, 1174 (6th Cir. 1972). Officials comply with NEPA “primarily by [conducting] an [EIS] for any ‘major Federal action significantly affecting the quality of the human environment.’” *Burkholder v. Peters*, 58 F. App’x 94, 96 (6th Cir. 2003) (quoting 42 U.S.C. § 4332(2)(C)). [Ref. - <http://www.ca6.uscourts.gov/opinions.pdf/10a0374p-06.pdf> Per No. 09-5761 *Heartwood, Inc., et al. v. Agpaoa, et al.* there is standing to challenge the current exposure guidelines because you have suffered an 'injury in fact' that is concrete and particularized; is actual or imminent; is traceable to wireless exposure; and that it is likely that this injury will be redressed by lower exposure guidelines.]

6. US citizens and tax payers deserve radiofrequency radiation safety limits based on

biology, not physics. In order for the FCC to fulfill its Congressional mandate to protect the public health and safety from harm from radiofrequency radiation, it must update its RF safety regulations. "In the Telecom Act of 1996 Congress directed the FCC to set its own RF safety regulations for emissions from Personal Wireless Services Facilities (PWSF). The House Committee on Commerce said it was the Commission's responsibility to adopt uniform RF regulations "with adequate safeguards of the public health and safety." (H.R. Report No. 104-204, p. 94)

In conclusion, a moratorium should be placed on sales of new spectrum, transmitting utility meter installation and installation of additional base stations for wireless service while biologically-based safety limits are being developed.

September 3, 2013
Miriam D Weber, NMD, L.Ac
Tucson, AZ

Radiation Sickness; Junghie Elky Comments, Sep. 3, 2013

Comments on Notice of Inquiry, ET Docket No. 13-84

The current RFR exposure limits have impacted my well-being and caused me to experience health problems. I have had the experience of electro-sensitivity, which is basically being “allergic” to electromagnetic fields (EMFs) and man-made radio waves, with symptoms including dizziness, headaches, pains, including ear aches, and, most notably, fatigue, by being near them. I remember quite distinctly getting a headache in the back of my skull that lasted for many hours, even lingering until the next day, when my children were communicating wirelessly with each other on their Nintendo DSes in the car while I was driving. The head tightening came on when they started playing. I noticed the same headache when my daughter came walking in my direction while talking on the cell phone. I was not even aware she was on the cell phone (I was in a bedroom, when she came walking down the hallway). I used to sleep with a portable phone next to my bed, but I would invariably wake up when my muscles on the top of my head would twitch and have spasms in the direction of the phone. My hand would have a shooting pain when even touching a cell phone. We used to have something plugged into our wireless router that would boost the wireless signal through our wiring. I felt sick and awful just to be inside the house without knowing why, until finally, I found out, through my husband, about this technology and unhooked it. Immediately, I felt better and could at least stand to be in my house. Being under fluorescent tubing would make feel dizzy and fatigued. These are just a couple of examples of how radio frequencies had adversely affected me at a time when I was especially sensitive.

Thankfully, I have since recovered from electrosensitivity (for the most part at least; when I get too tired and am around computers or cell phones, for example, I notice some of the same symptoms of dizziness start. When turning on a cell phone, I sometimes feel like a strong magnetic pull/dizziness toward the direction of the phone).

I believe my exhaustion from constant overwork weakened and made me susceptible. While I am much better now, after having avoided or reduced my exposure to EMFs and man-made radio frequencies and doing a variety of holistic therapies to make me stronger, I know that exposure to man-made radio frequencies can be harmful to those who are susceptible. These include people who may not have the strongest constitutions and/or who may have become fatigued through too much stress or overwork/lack of sleep, combined with too much exposure to EMFs and radiofrequency, such as through their occupations. There are many well-documented cases in books and articles of electrosensitivity in people and probably a lot of undocumented cases. These are people from all walks of life and include those in “respectable” professions, such as doctors, nurses, engineers, and artists. They/we are not crazy or imagining our symptoms and know that radio frequencies can and do harm, especially through excessive exposure. Anyone who has had electrosensitivity knows what it’s like and knows it is a very real, unmistakable experience of essentially being hypersensitive to EMFs and man-made radio frequencies. There are objective studies that show clear, convincing cause-and-effect relationship between man-made radiofrequency radiation exposure and health problems, such as cardiac arrhythmias.

I think it is exceptionally important now to reduce human (and wildlife) exposure to man-made radio frequencies, as never before has the planet experienced such levels of unnatural radiation—our bodies are now swimming in a sea of unnatural frequencies. The younger the body, the more

exposed they are. It is really alarming to think how much unnatural radiation our children are and will be exposed to in their lifetime. It is unprecedented and, basically, a big science experiment to see the long-term effects with our children as the guinea pigs. Thus, for future generations, we must reduce radiofrequency radiation exposure now.

Thank you for this opportunity to comment.

Radiation Sickness; ADA/FHA; Catherine Kleiber Comments, Aug. 30, 2013

FCC 13-39

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Reassessment of Federal Communications	)	ET Docket No. 13-84
Commission Radiofrequency Exposure Limits and)	
Policies)	
)	
Proposed Changes in the Commission's Rules	)	ET Docket No. 03-137
Regarding Human Exposure to Radiofrequency)	
Electromagnetic Fields)	
)	

To: Office of the Secretary
Federal Communications Commission
Washington, DC 20554

Comment Filed by: Catherine Kleiber
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August 30, 2013

AFFIDAVIT OF CATHERINE KLEIBER

State of Wisconsin]
] ss.
County of Jefferson]

CATHERINE KLEIBER being duly sworn deposes and says:

1. My name is Catherine Kleiber. I live in the country at N9387 Riverview Drive, Waterloo, Wisconsin.
2. My husband and I have lived on our farm in Waterloo, Wisconsin since 1996.
3. The existing FCC radiofrequency radiation limits are too high to protect human health. The limits need to be lowered immediately. New safety limits should be enacted using a biologically-based model.
4. I categorically disagree with the FCC's statement in paragraphs 8 and 9 and footnote 10 that a NEPA evaluation is unnecessary and premature. The FCC fails to consider that there are actually two options needing evaluation - the considerable environmental and human health costs of doing nothing and the environmental and human health benefits of basing safety limits on biology, along with the monetary costs of both. This is a situation that calls for NEPA review, *Envtl. Def. Fund v. Tenn. Valley Auth.*, 468 F.2d 1164, 1174 (6th Cir. 1972), specifically a formal Environmental Impact Statement (EIS) . My experience alone, outlined below, provides the evidence of injury under existing inadequate radiofrequency (RF) limits, causality, along with the potential for remedy with the enactment of meaningful biologically-based RF safety limits that, indeed, necessitates a full NEPA evaluation of the options - keeping RF limits at thermal levels or setting meaningful biologically-based RF safety limits.
5. The NEPA evaluation and EIS are necessitated by the presence of two options which have the potential to have radically different impacts *Burkholder v. Peters*, 58 F. App'x 94, 96 (6th Cir. 2003) (quoting 42 U.S.C. § 4332(2)(C)). The EIS should include a review of the impact of both options on the environment, as well as on human health and safety. "The Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees" commissioned on 30th August, 2010 by the Ministry of Environment and Forest, Government of India (incorporated by reference herein in its entirety http://www.moef.nic.in/downloads/public-information/final_mobile_towers_report.pdf) and "Impacts of radio-frequency electromagnetic field (RF-EMF) from cell phone towers and wireless devices on biosystem and ecosystem – a review," (incorporated by reference herein in its entirety http://www.biolmedonline.com/Articles/Vol4_4_2012/Vol4_4_202-216_BM-8.pdf) both provide enough compelling evidence of potential environmental harm at existing RF

limits to necessitate an EIS evaluating existing limits compared to biologically-based RF safety limits.

6. On September 1, 2012, in response to the evidence contained in the “Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees,” India dropped its maximum transmission limits to one tenth of its previous limits, already lower than U.S. permissible limits, and placed a moratorium on installation of antennas within 1 km of each other. India continues work on a more final rule. This shows that the substance of the report is indeed compelling.
7. The FCC has a duty to the public to protect the public health and safety from harm from radiofrequency radiation (H.R. Report No. 104-204, p. 94).
8. In May 2011, IARC classified radiofrequency radiation, including radiation from all wireless technologies, as a class 2B possible carcinogen.
9. In the 2012 BioInitiative Report, the authors conclude radiofrequency radiation is a carcinogen. One mechanism responsible for the carcinogenic effect of radiofrequency radiation is its ability to initiate the Fenton Reaction, just as ionizing radiation does. The 2012 BioInitiative Report is incorporated by reference herein in its entirety (<http://www.bioinitiative.org/>)
10. The FCC radiofrequency radiation limits are outdated and obsolete. They are based on physics, not biology and, therefore, the limits are so high that they are useless for protecting the population from harmful biological effects. “*Public safety standards are 1,000 – 10,000 or more times higher than levels now commonly reported in mobile phone base station studies to cause bioeffects.*” (<http://www.bioinitiative.org/conclusions/>)
11. Since the FCC lacks the expertise to establish meaningful biologically-based safety limits, it is the duty of the FCC to advocate for allocating funding and authority to the EPA to establish biologically-based safety limits. 2012 HR6358 exists as a model of legislation to do just that.
12. The FCC is not entitled to essentially disregard comments from citizens because they cannot provide global cost-benefit analysis (*Scenic Hudson v. Federal Power Commission*), as is suggested by paragraphs 109 and 209. The Commission has an affirmative duty to inquire into and consider all relevant facts. They must use government resources to perform the relevant analysis. The FCC should request that the EPA use its taxpayer-funded resources and experts present at its National Risk Management Research Laboratory to conduct all of the cost analyses the FCC has asked for in this proceeding.
13. In paragraphs 66, 67, and 68, I provide information about the monetary costs incurred by me and my family as a direct result of the FCC's negligence in not putting into place biologically-based RF safety limits years ago. The emotional and social costs

have also been very steep. None of the common uses of wireless technology comes close to justifying the monetary, physical, emotional, and social price our family has been forced to pay for it.

14. My family's on-going health nightmare, caused by the presence of biologically active levels of radiofrequencies on the electrical grid and radiofrequency radiation transmitted into the environment through use of wireless technology, is illustrative of why it is essential that the EPA finally be empowered to establish biologically-based radiofrequency radiation safety limits.
15. I have radiowave sickness. (See Dodge, incorporated by reference herein in its entirety http://www.magdahavas.com/wordpress/wp-content/uploads/2010/08/Dodge_1969.pdf) It was originally misdiagnosed as chronic fatigue syndrome. However, once I found out I was being exposed to large amounts of high frequencies from electrical pollution, including "dirty" power on my wires and plumbing, and reduced that exposure as much as I was able, I began to recover almost immediately.
16. Here is a brief summary of symptoms I experienced during my high frequency related illness: heart palpitations, very pain sensitive, constant nerve pain, sluggish reactions, poor depth perception, muscle weakness, lactic acid buildup with little exertion, unrefreshing sleep, often wakeful in the night, fatigue, night sweats, poor circulation to my extremities, reflux, difficulty concentrating, difficulty thinking, inability to make decisions, low-grade fever and chills, headaches, and a dry sore throat.
17. We have reduced our exposure as much as possible. I was well at home until smart meters on our neighbors' homes, power line communications frequencies, and 4G cell service increased our exposure enough that I began once again to experience symptoms even while in our home. We have taken additional steps to reduce our exposure to the pulse modulated microwave radiation used in wireless technology and high frequency power line communication signals.
18. I get sick again whenever I am around higher levels of high frequencies such as when I go into town. The degree of sickness and the exact symptoms vary depending on the duration and strength of the exposure, as well as the particular frequencies to which I am exposed.
19. The ambient levels of pulsed microwave radiation are now so high that I can no longer even try to go to friends' and relatives' homes, restaurants, movies, public events, or "shopping" - in the event I have to go into a store I try to arrange ahead for the item I need to be ready for me or I go in quickly, ask for assistance finding the item, buy it and leave.
20. I have had serious radiation sickness reactions to these polluted environments including cardiac arrhythmias, cognitive difficulties, short and long-term memory problems, severe neurological pain, hair loss and serious gastrointestinal effects if I try to stay longer. (See "Provocation study using heart rate variability shows

microwave radiation from 2.4 GHz cordless phone affects autonomic nervous system,” incorporated by reference herein in its entirety (http://electromagnetichealth.org/wp-content/uploads/2010/10/Havas_HRV_Ramazzini1.pdf)

21. One meeting, where cellphones and wifi were present, followed by what should have been a quick trip to an office supply store, which had gotten a wireless telephone headset system since my last visit, caused serious radiation poisoning symptoms. I had cardiac arrhythmias from the radiofrequency radiation at both locations. Nerve pain began toward the end of the meeting and grew worse at the store and was so bad by the time I got home that I had to limit how my children could touch me for a couple of days. Serious gastrointestinal pain and dysfunction resulting in massive diarrhea began very shortly after arriving home and finally began to subside 3 days later. The pain and diarrhea were so severe with food that I had to quit eating for a couple of days while my intestine healed. The symptoms began at the meeting and quickly escalated while I waited nearly twenty minutes for service at the store and persisted for over 3 days. The association between the exposure and the symptoms was very clear. I consumed no food at the meeting or at the store. I had no symptoms of a bacterial/viral infection.
22. We have two small children whom we are homeschooling so they will not be exposed to dangerous high frequency environment in our local public school (Waterloo, WI). The school has both WiFi and high electrical pollution levels.
23. Our children both experience health problems when exposed to high frequencies. They feel sick, become hyperactive, less able to think logically and control their behavior. They also sleep poorly in bad high frequency environments. The recent increase in radiofrequency radiation exposure has given them chronic cardiac arrhythmias which worsen markedly when they are exposed to the higher levels of pulsed microwave radiation common in society within the last couple of years. (Video demonstrates finding of cardiac arrhythmia caused by DECT phones - http://www.youtube.com/watch?v=p-mw_nCJWs4&list=UUxs1UgZ6DivWUfG1dX3TELw&index=10)
24. The drastic measures we have taken to reduce their exposure has momentarily stabilized them at about early stage 2 radiofrequency sickness. (See Dodge) We are very concerned that any increase in the radiofrequency radiation levels could again push them over the edge toward stage 3 radiofrequency sickness. They should not be involuntarily exposed to a pollutant that has such profound detrimental effects on them.
25. I have maintained the website www.electricalpollution.com since 2002, shortly after I discovered that the high frequencies present on building wiring and flowing across the ground from non-linear time varying loads were making me, and others, sick. Research on the health effects of electrical pollution is available on the website on the Research Page. More technical information is available on the Technical Page.

Electrical pollution is a very potent form of exposure to high frequencies. Exposure to all forms of high frequencies, including electrical pollution, must be included in standards regulating exposure of the general public to protect the public health during continuous exposure.

26. Because of the serious effects exposure to high frequencies has on our health, we do not own a cellphone, cordless phones, wireless router, baby monitors, or subscribe to wireless internet.
27. I have read widely on the research into the health effects of exposure to high frequencies. I believe that the increased exposure to high frequencies from radiowave and microwave transmitters and from electrical pollution are behind the public health crisis that has dramatically increased utilization of our medical system for chronic conditions. The article by Halberg and Johansson in *Pathophysiology*¹ supports this contention. The comprehensive review by Dr. Cherry, which documents health effects and explores mechanisms, besides thermal mechanisms, through which microwave and radiowave radiation can impact health, also supports my contention that exposure to microwave and radiowave radiation is a public health threat which is probably contributing to significant public illness. A review of the Soviet literature on radiofrequency sickness by Christopher Dodge³ of the Naval Observatory discusses radiofrequency sickness in detail. The symptoms attributed to chronic exposure to radiofrequency radiation mirror the deterioration of health being seen in the U.S. in recent years, probably due to the dramatic increase in exposure to radiofrequencies from electrical pollution and wireless technology. Papers by Dr. Milham⁴, Dr. Havas^{5,6,7} and Dr. Wertheimer⁸ also show that exposure to electrical pollution constitutes a public health threat, as does a report by Char Sbraggia regarding health improvements experienced by teachers and students when the electrical pollution in their school was cleaned up (MelMinNurse.pdf). These are just a few of the papers I have read. However, they provide a picture which should illustrate the need for precautionary action to halt the expansion of public exposure to high frequencies until safety standards can be established to prevent health problems in the general population during continuous exposures to high frequencies, taking into account all sources of exposure.

1. Ö. Hallberg, O. Johansson, Apparent decreases in Swedish public health indicators after 1997 — Are they due to improved diagnostics or to environmental factors? *Pathophysiology* (2009)
2. Cherry, N. 2000 Criticism of the Health Assessment in the ICNIRP Guidelines for Radiofrequency and Microwave Radiation (100 kHz- 300 GHz)
3. Dodge C. Clinical and Hygienic Aspects of Exposure to Electromagnetic Fields. Biological Effects and Health Implications of Microwave Radiation, Symposium Proceedings, Richmond, Virginia, September 17-19, 1969.
4. Milham S, Morgan L. 2008 A New Electromagnetic Exposure Metric: High Frequency Voltage Transients Associated With Increased Cancer Incidence in Teachers in a California School. *American Journal of Industrial Medicine*.
5. Havas M, Olstad A. 2008. Power quality affects teacher wellbeing and student behavior in three Minnesota Schools, *Science of the Total Environment*, July.

6. Havas M. 2006. Electromagnetic hypersensitivity: biological effects of dirty electricity with emphasis on diabetes and multiple sclerosis. *Electromagnetic Biology Medicine* 25(4): 259-68.
 7. Havas M. 2008. Dirty Electricity Elevates Blood Sugar Among Electrically Sensitive Diabetics and May Explain Brittle Diabetes. *Electromagnetic Biology and Medicine*, 27:135-146.
 8. Wertheimer N, Savitz DA, Leeper E. 1995 Childhood Cancer in Relation to Indicators of Magnetic Fields from Ground Current Sources *Bioelectromagnetics* 16: 86-96.
28. I knew that an increase in levels of transmitted radiofrequency and microwave radiation would be very detrimental to my health and that of my family and would further impair our ability to live a normal life.
29. Therefore, we refused installation of the We Energies AMR meters, which transmits a spike of microwave radiation (approximately 1800 $\mu\text{W}/\text{m}^2$) every 6 seconds 24 hours a day, 7 days a week, on our two electrical services.
30. I asked for reasonable accommodation under the ADA because I knew that my children and I experience environmentally induced functional impairment with exposure to radiofrequency radiation, including the pulsed modulated microwave radiation utilized by the We Energies AMR meters.
31. My initial request was denied verbally by the PSC and in writing by We Energies.
32. We had to turn away at least one installer who came to install meters after we were on the record with We Energies and the PSC as not wanting an AMR meter installed.
33. We were concerned that we would find AMR meters installed despite our clearly expressed refusal to have AMR meters, so we padlocked our meter pedestals and installed clearly worded permanent signage.
34. In response to our continued refusal to allow installation of the meter, we were threatened with disconnection. (See WeEnergies9Dec2011.pdf)
35. My mother and father-in-law tried to refuse to take a transmitting meter so we would still be able to visit and were bullied into taking the meters by a disconnect threat. We can no longer visit. Our one try was cut short by our younger son feeling so ill that he was crying and begging to leave - in spite of it being Christmas with relatives, presents, and candy.
36. Both We Energies and the PSC maintained, over the phone and at the meeting with the legislators, that we had three choices and represented them as accommodation.
1. Take the AMR meters.
 2. Take the AMR meters and move them anywhere on our property at our considerable expense (thousands of dollars to move them even short distances).

3. Get off-grid.

37. We do not consider these choices to have been any form of accommodation since we could not have moved the meters far enough to protect our health. Also, the radiofrequencies the meters produce get on the wires, essentially turning the house into a low-power microwave. This proved to be a problem even though our nearest neighbor is over half a mile away. Having two meters of our own would have worsened the effect.
38. We consider the refusal to accommodate us and the threat to disconnect us to have been bullying and intimidation on the part of We Energies and the Wisconsin Public Service Commission.
39. A group of us met with state legislators (Sen. Grothman, Rep. Jorgensen, and Connie Schulze, a staff-member of Sen. Darling's, who were supportive, but unwilling to sponsor legislation to help us.
40. I called numerous federal agencies - to no avail.
41. In March 2011, we received a letter from We Energies threatening to disconnect us within 48 hours for denying them access to the meter pedestal, which we own. This, in spite of the fact that, during a conversation about the supposed safety issue and the fact that We Energies can easily disconnect power to our farm at our transformer in case of an emergency, Tom Held (Supervising Engineer Meter Technology) concurred saying "I know. They can pull the fuse."
42. We had been customers in good standing.
43. Again we appealed to the PSC for accommodation under the ADA (PSCMarch2011WEcutoff.pdf) and asked that they address the radiation coming off of our transformer and causing cardiac arrhythmia for our son, only to be told that they would stand by and watch us disconnected, although they would make We Energies wait until after April 15. They did not address the dangerous radiation at all.
44. After consulting multiple lawyers, realizing that the sole power to provide or deny accommodation resided with the PSC, and even being told outright by one lawyer that our best bet was to get off the grid, we began making preparations -at considerable expense- in case we were forced off-grid, fighting all the while.
45. We got a propane refrigerator, a pilot light gas stove, installed a gravity flow hot water heating system, acquired a generator to run our commercial freezer and installed a solar photovoltaic system to run a new DC well pump and sump pumps and converted our computer to run on DC.
46. We felt that the PSC was in violation of its own statutes in standing by and watching customers in good standing get disconnected and that We Energies was in violation of

the law, but with no one to defend us, we had no recourse other than the one easily accessible public forum - a Letter to the Editor. (We had contacted various legal organizations including the ACLU, Public Citizen, Common Cause, and NRDC. All said that they have limited funding and they had never heard of this before. News outlets were similarly uninterested - utilities and telecom companies provide substantial funding through advertising or outright ownership.) We did also reply to the PSC.

47. The PSC once again refused to exercise their right to stop We Energies from disconnecting us for refusing the transmitting meter.
48. The PSC refused to accommodate us in large part because the AMR meters were supposedly in compliance with FCC radiofrequency limits (see PSC27Apr2011reDATCP.pdf), in spite of the fact that FCC limits were never intended to protect anyone from the biological effects we experience. Compliance with FCC limits has been used to force many many people from across the country to have devices which compromise their health.
49. After we wrote the letter to the editor, Sue Crane, Manager Special Projects at We Energies contacted us and asked that we remove the padlock stating that she would personally guarantee in writing that the meters would not be changed for 6 months.
50. On October 8, 2011, we sent letters to the PSC and We Energies requesting that they remove our electrical service since they had repeatedly ignored our requests to address the problems on their system that were causing large amounts of very high frequency radiation to radiate off of our transformer and our house wiring.
51. We had been forced to sleep in a tent a half mile from our home site (and at least that from other electrical services) from the end of July through October 13, 2011 - the start of early deer hunting season - in order to stabilize our sons' cardiac health. (From the start of deer hunting until the secondary wires were removed on October 19, 2011 we slept in the bed of our full-sized truck parked in our metal machine shed with the openings facing the transformer electrically shielded and the bed opening away from the transformer. The electrical service to the shed was already disconnected thus preventing it from conducting the radiofrequencies in.)
52. Both sons were affected, although our younger son was affected more severely. After initial tachycardia incidents which we became aware of in the fall of 2010, they moved on to irregular heartbeat and heart rate which finally got quite slow and irregular, particularly during sleep. Additionally, Holter monitoring found that both boys had sinus arrhythmia. This is consistent with the descriptions of stages one and two of radiofrequency sickness in Dodge (attached). On a Holter monitor, our younger son only had a high of 242 bradycardia incidents hourly at the tent versus 1637 hourly at home. Our older son had a high of 165 bradycardia incidents hourly at home with no comparable due to a mistake on the part of the hospital. Our younger son's heart rate got so slow one night when we were forced by broken tent poles to

sleep at home that he lost bladder control, wetting only his underwear because the volume of urine was so small. When I went to him in response to his call, he was agitated and upset, but his heart rate was very slow and the beats were weak and irregular. This continued for a couple of hours. We did not sleep in the house again after that until after the secondary lines were removed.

53. The deterioration in our health began shortly after the smart meters were installed in our area. Strong power line communication signals (likely related to broadband over power lines) in the 12.4 to 13.2 MHz and 25.5 to 26.3 MHz range along with communication signals radiating from our end of the line transformer and our home wiring seem to have been the final straw.
54. Signals in the 1 MHz to 80 MHz range used for broadband over power lines and communication signals are not supposed to cross the transformer. However, what happens when the signal hits the end of the line has not been considered as far as I know. Our experience suggests that it radiates and does cross the transformer enough to radiate off of the wiring and plumbing throughout the house at biologically-harmful levels.
55. We are now off-grid to protect our family's health.
56. After going completely off-grid, I had three heavenly weeks. I slept well, felt well, and had lots of energy. Our pets' health improved. Most importantly, our sons' cardiac rhythms had almost completely normalized and I was not awakened in the night.
57. Then, in early January 2012, 4G cellphone service was installed in our area. Within a week, our sons' cardiac rhythms were again highly irregular. Our younger son was again waking us in the night crying, sweating profusely, and feeling unwell with a highly irregular cardiac rhythm. He was also clingy and fussy during the day.
58. My husband screened all the windows with aluminum screen to reduce his exposure. Again, he slept through the night and was less clingy, but their cardiac rhythms remained irregular.
59. We are currently essentially housebound, unable to spend significant time in houses or businesses which have transmitting meters, which includes almost every electrical service in our area.
60. Due to the detrimental health effects that we experience, we are unable to visit friends and relatives who have transmitting meters.
61. We cannot completely escape the constant exposure from neighbors transmitting utility meters, 4G cellphones, and the power line frequencies which still radiate from the junction box down the road that terminates the line.

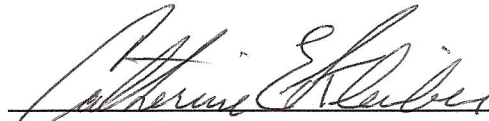
62. As 2012 passed, we had to do more and more shielding to compensate for the ever increasing levels of radiation from wireless technology. We have had to restrict the amount of time our outdoors-loving sons can be outside. They are now only able to be out an hour a day. If they are out more than that with any regularity their cardiac arrhythmias become severe enough that they become clingy and we are awakened in the night.
63. I have not been able to do all the animal care, yard care, and gardening that I need to do in the course of the year. The garden is overgrown. I have not even been able to keep the few potatoes I planted weed-free. Obviously, I cannot fit duties that usually took me 6-8 hours daily into the one hour they can be outside without triggering more serious cardiac arrhythmias. I have trouble performing the physical labor I always have and must do to earn our living since my heart often does not beating efficiently, due to the radiofrequency radiation levels.
64. Radiofrequency radiation levels have climbed high enough that even being inside most of the time is not protective enough to keep our sons from being symptomatic. We have had to begin shielding further. Every little bit helps for awhile, then more people use their phones more, stream video more, etc and the levels increase further and we have to shield some more. How long before radiofrequency radiation levels climb high enough that being outside at all is dangerous? What happens when we have shielded the whole house and even so being inside does not offer enough protection? Who could take care of and protect my boys if anything happened to me and my husband?
65. I worry that I will run out of shielding options to protect my sons before meaningful biologically-based safety limits put an end to the insane increases in radiation exposure occurring rapidly now as usage of wireless technology increases. Radiofrequency sickness is serious and is life-threatening if it is not able to be properly treated by avoidance once it occurs.
66. The meters necessary to verify RF related problems cost over \$1,500. Going off-grid, which was necessary to protect the lives of our sons, cost us over \$70,000 dollars based on simple addition of the costs of all the separate parts and steps necessary to make that happen. The cost was that low because we were able to do much of the work ourselves. The solar installer estimated that the system we wished to put in at that time would cost us over \$80,000 just for the solar system, not including the new heating system, refrigerator, well-pump, super-insulating the freezer, freezer generator, freezer/generator control switches, etc.
67. Shielding materials have cost us over \$2,500 so far, also based on simple addition, and are likely to cost us at least \$4,000 more just for the shielding materials, also based on simple addition. It has cost over \$7,000 to get new windows for the low E coating which helps block RF, again far less than most people would pay because we can install them. I cannot stress enough that these are only the monetary costs and do not include the physical, emotional, and social price our family has been forced to pay

for the FCC's negligence in not implementing biologically-based safety limits. We are not wealthy and do not earn vast sums each year so it is a real question as to how long we can continue to pay for the continuous upgrades necessary to protect our family's health, yet how can we not? But, if we lose the farm doing it, what will happen to us?

68. FCC negligence in not establishing meaningful RF safety limits has caused us to pay more for my health insurance and therefore our sons' health insurance. The CFS diagnosis, which was really radiofrequency sickness from exposure to dirty power, caused me to become an automatic reject for health insurance. I was fortunate to be able to get health insurance through the Wisconsin Health Insurance Risk Sharing Plan (HIRSP), however even with the subsidy it was quite a bit more expensive than insurance I could have gotten as a healthy young woman. We had to have HIRSP policies for our sons as well, not due to their health which was great prior to the RF toxicity problems outlined above, but because you cannot insure children without at least one adult as primary on the policy. As an example of the great expense this caused us, the insurance quote we got in 2012, necessary to re-apply to HIRSP, for the whole family was \$713.54/month. The premium for my insurance alone through HIRSP at that same time for the same \$1.000 deductible was \$729/month. HIRSP premiums at that same time and deductible level were \$554/month for Dan and \$387/month for each of the boys. Up until the 2008 flood and policy changes allowed us to qualify for health insurance assistance we were paying similar large monthly premiums. Thus, FCC negligence, resulting in the absence of biologically-based RF safety limits and my CFS diagnosis, forced our family to pay significantly more for health insurance than we would otherwise have had to.
69. It is important to stress our experience has been that people with radiofrequency sickness react to both RF exposures from wireless technology and "dirty" electricity.
70. The FCC is jeopardizing the health and lives of our children, and millions of others across the country, by not having meaningful biologically-based safety limits for radiofrequency radiation.
71. Not only is the absence of biologically-based RF safety limits in violation of common sense and the principles of public health protection, but the promotion of wireless technology, a technology that so severely restricts the activities of a portion of the population, violates the ADA, including the 2008 ADA amendments. The physical, social, and emotional costs of exclusion in spite of ADA protections and previous inclusion must be weighed in the EIS when it compares costs and benefits of the existing RF limits and enacting biologically-based RF safety limits.
72. We do not want to continue to be guinea pigs for the government-sanctioned rollout of new technologies with insufficient safety standards. We do not want to continue to be part of the experiment being involuntarily carried out on the American people verifying the results of decades old research showing that the long-term health effects of these wireless signals can be profound and dangerous. (See Dodge)

73. The levels of radiation our family experiences on a daily basis from transmitting utility meters, wireless broadband, cellphones, cell towers, and other sources, - WITHOUT OUR PERMISSION - is already causing serious daily health problems for us.
74. Without conservative safety standards designed to protect the public health of our entire population during continuous exposures from all detrimental health effects and the rigorous enforcement of such standards, we fear the long-term hazards to our family's health.
75. We have a right to be safe in our homes and our schools and workplaces, and we have a right to current safety standards based on current science, not mistaken assumptions (the thermal model) and wishful thinking.
76. The existing FCC radiofrequency radiation exposure limits are way too high. Severe biological effects occur at far lower levels, as demonstrated by my family's experience, as well as in studies. If the FCC persists in ignoring this fact and does not adopt biologically-based radiofrequency radiation safety limits, it will be directly responsible for the ill health, even death, of millions of people. (See the 2012 BioInitiative Report - <http://www.bioinitiative.org/> - for mechanisms and diseases for which links have been made in recent scientific literature and Dodge - incorporated by reference herein in its entirety http://www.magdahavas.com/wordpress/wp-content/uploads/2010/08/Dodge_1969.pdf - for connections made over 40 years ago.)
77. I reaffirm that the information contained in the paragraphs above are true and correct.
78. End of affidavit.

Dated this 30 day of August 2013.



Signature of Person Making This Affidavit

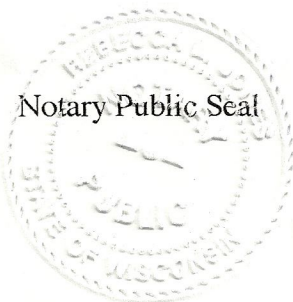
State of Wisconsin]

ss.

County of Jefferson]

Subscribed and sworn to (or affirmed) before me this 30th day of August, 2013, by Catherine Kleiber of N9387 Riverview Dr., Waterloo, WI 53594, personally known to me or proved to me on the basis of satisfactory evidence to be the person who appeared before me.

Notary Public Seal



Signature of Notary Public

Rebecca L. Jones

4-17-14

Radiation Sickness; Amanda & Ryan Rose Comments, Sept 3, 2013

Attachment 1. The Filer

We, the filer, Amanda & Ryan Rose, are strongly in support of decreasing exposure limits through FCC regulation. Current FCC exposure limits are based on the cellular heating effects of wireless, not the many other biological cellular effects. As surely you must know, a very significant research effort has been underway for many years, beginning in the mid-90s and increasing dramatically in the last several. These results indicate serious effects from constant or frequent, repetitive exposure to wireless fields that negatively impact the cellular functioning of all lifeforms, the basis of all life. We reference here the Bioinitiative Report (over 600 pages, produced mostly by pro bono contributions of concerned international scientists, and not attached here out of courtesy due to page length); scientists at the Nobel prize-winning Karolinska Institute in Sweden; the conversion from pro to con of Dr. Devra Davis, an original proponent of, and contributor to, the 1996 Telecommunications Act, who has reversed positions and is now actively involved in the international research effort to prove, unequivocally, that there are dangerous biological effects from wireless radiation as currently allowed; and many others, including the recent decision of the Supreme Court of the nation of India (See **Attachment 2**, a .pdf portfolio, which is somewhat voluminous, but the decision of the Supreme Court of India is on two pages at the end) to limit and REGULATE wireless, to use that word that is anathema to ideologues who believe in deregulation of every sort, whether rational or not. **Attachment 3**, "Governments And Organizations That Ban Or Warn Against Wireless Technology," provides a March 2013 listing of international governments and organizations that favor decreasing or eliminating exposure limits. Also, as you may know, Electromagnetic Sensitivity is recognized by the Americans with Disabilities Act, the US Access Board, and numerous commissions.

We have discovered from personal experience that there is a threshold beyond which these effects become apparent through deleterious health symptoms. In our case (the filer), our entire family has experienced these symptoms, even though we have never installed wireless in our home nor owned a cell phone. A short summary of the three of us and our history/symptoms follows:

Son, formerly exposed only seldom before leaving home for college, and with NO history of seizure, experienced a *grand mal* seizure in his second year of college, where he was exposed 24/7 in classrooms, dormitory, and throughout the campus. The seizure was brought to a close by inducing a coma. Emergency room and follow-up hospital diagnosis failed to prove any cause, although later, a physician specializing in multiple chemical sensitivity and electromagnetic sensitivity, recognized the symptoms as electromagnetic sensitivity. His reaction diminished over a fairly short time because he left the 24/7 field by returning home to this very rural area, learned stress management techniques, and began taking anti-seizure medication. He is now at Cornell in a Ph.D. physics program. The only way he can complete his higher education and live in the conventional world is with anti-seizure medication and stress management. We all consider this a very expensive travesty, but are aware that his considerable attention to stress management techniques, which are beneficial practices, is essential in managing his condition as well as the side-effects of the drug, which we hope will not increase. (See **Attachment 4**.)

Mother (Amanda Rose, filer 1 of 2) crossed her threshold, or alternatively, developed symptoms, when a neighbor installed wireless that radiated into our home: When I first heard about wifi sensitivity, I must admit it seemed really off the wall. That is a very common response, quite likely because our country is not paying attention to the issue as deeply as Europe, Israel, and India are, and because one cannot see, touch, smell or taste wireless. It exists, but not to our usual senses. Although skeptical, once I crossed the threshold I could not continue to deny this as a very serious and real disability. The most common problem is the first one I noticed: inability to think well. I was trying to plan our son's high school graduation and could not figure out who was invited or what food would be served. I am of decent intelligence, an avid cook and delighted with our son; there was no reason this should have been so difficult. I would sometimes simply sit and cry because it was so utterly frustrating that I was having such difficulties with these simple tasks. It is quite common for those who have this sensitivity to take hours to accomplish something that normally would have taken very little time and would be easy to do. The source of the wireless signal was from the home behind ours and was in direct line through our large kitchen window. I often felt really bad when doing the dishes right at the window. I had had a mole on my back that my health care provider had repeatedly warned me to have removed, as it seemed likely to become cancerous. Within a few months of the neighbor's installation of wifi, it did. Fortunately, I have not had any recurrence after having it removed. With these issues we decided to talk to our neighbor about removing her wifi and going to DSL instead, which we offered to pay for. She basically refused although she eventually said she would turn it off when not in use. That meant that occasionally she turned it off for a brief stint. I found that I usually knew when it went off and when it went back on, as I would suddenly feel better and then suddenly feel worse again. I never knew when she would be choosing to turn it off or on, but my body could tell me. Eventually she took us up on our offer to remove wifi and install a landline phone and DSL. This phenomenon of knowing when I am in a wifi field has persisted over the years. Just recently I attended a dinner celebration at my husband's workplace where we had made sure that all the wireless was turned off for the evening. However, after the dinner as I relaxed and the intensity of riveted discussion fell away, I noticed that I felt as though I had been in heavy wifi, and could not understand how that could be. The next morning it dawned on me that most of the folks at the dinner had cell phones, and so I was being bathed in EMR after all. The lady referred to above moved out within about 6 - 9 months of us paying her DSL bill, and the new tenant agreed not to use wireless. However, after several months I began feeling symptoms at home again and did not know why. I picked up a wifi hotspot detector and, to my shock, found we had a wireless signal in the house again. I followed the signal, via the device's bar-intensity readout, to her house and asked her if she had started using wifi, to which she answered *no*. The next morning I suddenly felt much better and looked at the clock - 10am. Later that afternoon she saw me and told me that, sometime earlier, she had been given a router which she was not using, but had discovered that it was *on*, and that she had turned it off at 10am. The instances in which I think that I am not in wifi, but my symptoms tell me I am, are numerous. It is almost like I am a flower that wilts in wireless, and when I remove myself or have it turned off, it is like I have just been watered. I go to a nearby town once a week to do our shopping, and I take a day to recover from the almost ubiquitous wifi presence. **I cannot travel much, I cannot visit or help out with my father in Seattle who has Lewy Body disease and now Parkinsons, and do not go out to eat (almost all restaurants have wifi for their**

customers); I live a very small life. I sometimes wonder what would happen should I find myself needing to go a hospital, which are all full of many wireless signals, so that going to the hospital could be more harmful than the problem that might have arisen. It is a disconcerting thought. **Although we do all we can to keep our exposure as minimal as possible, I now have issues with my heart as well, and, I continue to find that wireless signals usually leave me feeling depleted and foggy-brained - at times I look like the life force has been sucked out of me.**

Father (Ryan Rose, filer 2 of 2). I was exposed, unknowingly, at work for several years, but upon returning home after work entered a no-wireless, or low-wireless, field. The home's outer walls are of thick adobe, constructed in the early 1900s, and are partially effective in reducing the penetrating nature of wireless. Furthermore, the bedroom is protected by two adobe walls, so sleep—the best time for physical rejuvenation—was fairly well insulated from invasive electromagnetic radiation. However, as mentioned in my wife's description above, the neighbor's installation of wireless (wi-fi) was enough 24/7 exposure to bring my body across the threshold. By the time I felt symptoms, my wife and two neighbors already had, and I was still skeptical. Nevertheless, one evening while washing a lot of dishes in the kitchen, which is closest to our neighbor and exposed through a large window and a frame add-on porch (non-adobe), I experienced what I can only describe as the oddest feeling: my stomach felt as if it turned over. I immediately realized it was my body's reaction to our neighbor's wireless. After that I was no longer skeptical, so as with so many people today throughout the world, I began, reluctantly, starting to learn about wireless, even though I was extremely busy with my consulting work. With a technical background (BS in Aerospace Engineering) and prior work with NASA on the Apollo Program (Cape Kennedy & Manned Spacecraft Center - Houston), I was in possession of the basic physics to begin that unwanted learning experience. That has led to this response to the FCC's request for Comments on Notice of Inquiry, ET Docket No. 13-84. My symptoms mainly manifest in digestive disturbance—nausea and achlorhydria. Occasionally, a mild headache will occur, of which I used to be blessed with none.

The two of us now refrain from exposure whenever possible. **So that you will know that we are serious about this**, we remind you that we paid for our neighbor to remove her wireless and install a landline. More recently, we found it necessary to request assistance from the USPS Inspector General in removing a wireless signal from our local Post Office, which is very nearby, as it had a signal that was invading our home and creating symptoms. It was removed quite quickly once our complaint was received (wireless is not permitted in postal facilities, probably because it interferes with their equipment). We understand that in the wake of Hurricane Sandy, no telephone/DSL land lines are being reinstalled in that area. This could be a very serious problem were that to happen to us, as it must be for any who have the same disability. Unfortunately, since this problem is not being discussed widely and is still not recognized by the majority in the medical profession, many are going undiagnosed.

As you know, there is a highly profitable and powerful cell phone/wifi lobby that would try to convince you that there are no health liabilities arising from their technologies. We request that the FCC delve into this issue more deeply than it has previously. Just think: if

wireless systems are found to need re-structuring, industry as a whole would have a rejuvenated source of revenue—new cell phones, new routers, modified towers, etc.

Radiation Sickness; Cindy Bowman Comments, Sept 3, 2013

FCC 13-39

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Reassessment of Federal Communications	)	ET Docket No. 13-84
Commission Radiofrequency Exposure Limits and)	
Policies)	
)	
Proposed Changes in the Commission's Rules	)	ET Docket No. 03-137
Regarding Human Exposure to Radiofrequency)	
Electromagnetic Fields)	
)	

To: Office of the Secretary
Federal Communications Commission
Washington, DC 20554

Comment Filed by: Cindy Bowman
P. O. Box 222
Bloomery, WV 26817
millabite@outlook.com

September 3, 2013

AFFIDAVIT OF Cindy Bowman

I, Cindy Bowman, attest that my statements are true to the best of my knowledge.

Comment round for FCC ET Docket No. 013-84 and ET Docket No. 03-137

1. My name is Cindy Bowman. My address is P.O. Box 222 Bloomery, WV 26817
2. I am unemployed due to illness, a condition known as electrical hypersensitivity.
3. (A) In 2004, I was assigned the task of taking phones calls at work. For this task I was given headphones which attached to my office phone. From that day, my life has never been the same.

(B)I began experiencing severe headaches, which dissipated a few hours after returning home. The next day I felt good, returned to work, and had another headache within a few hours of wearing the headphones. This phenomenon continued and soon after, I began having involuntary muscle twitches, insomnia, ringing in my ears, confusion, fatigue, inability to concentrate, dizziness, problems balancing and Alzheimer's-like memory problems. I would attend a meeting at work, take notes, and upon returning to my desk, was unable to read my own notes or even remember the meeting. I was unable to find a doctor who could help me. Barely two months later I had to leave my job because each day I went there, I was able to stay shorter and shorter times before becoming ill. By the time I left my job, I had or was experiencing more than forty physiological changes that resulted from my illness, and I was ill no matter what my location. I didn't wear headphones at any time other than for work; that was the only change in my life, and anything electrical, wireless or not, was affecting me by then. I would even experience muscle twitches when driving underneath a power line, when near a cell tower, or being next to a hybrid car in traffic. The remote control on satellite TV proved to be too strong for me; it caused many problems and I cannot be around them even now.

(C)After my headaches began I started noticing that other people at work who were taking phone calls didn't use the headphones. I started my own survey, asking why they didn't use the equipment provided by our employer. Many had headaches, some had confusion, and some had ringing in their ears after using the headphones. I reported this to the supervisor, and tried using a different pair of headphones. The supervisor said some people quit the job taking phone calls soon after beginning, but those people had been hired specifically to take calls and had not been employed very long. I had been employed there for over nine years but had not taken calls using headphones. I even tried using a private office using the speakerphone instead of headphones for taking calls but my symptoms continued to increase in number and intensity.

(D)I didn't want to leave my job but had to leave because I was no longer able to perform my duties due to my illness. The neurological changes in my body caused by my exposure to the electrical impulses in my environment were beyond imagination and I had trouble believing what I was experiencing, even while knowing that it was real and not imagined.

(E) Soon after becoming ill but before I left work, my husband contracted with a satellite TV service for football season. In my absence, my husband had the satellite installed above our bedroom window, directly above our bed. I had been staying with my mother for a week because she was ill. When I returned home, I couldn't sleep in the bed. I heard humming and vibration sounds that my husband couldn't hear. I convinced him that we should sleep with our feet under the window instead. That gave my feet and legs burning sensations, and I had to move out of the bedroom to sleep until we got rid of the satellite. I actually pitched a tent on our deck and slept outside while we had the dish. Although my husband did not experience any health problems due to the location of the dish, I felt them as long as the service was on. I turned off and unplugged the receiver box at night and when my husband was at work to stop the transmissions and hopefully feel better in my own home, but that accomplished nothing.

(F) Even before my illness began, I had used a cordless phone at home and noticed after some conversations, my inner ear felt as if it was numb, and my outer ear was hot. Switching ears while using the phone made both ears have the same feelings.

(G) I now use speakerphones exclusively, most often on corded phones.

(H) In the last month I learned the land behind my house is being considered for a cell tower site. Although I am attending local governmental meetings and voicing my thoughts, needs and ideas, if this tower is built, I will have to move. There are already eight towers within four miles of my property, according to Antennasearch.com. If this continues, I will have no place to move within the United States.

(I) The FCC's decision to review the guidelines of RF Safety is to be applauded. I believe a change to lower the FCC RF safety guidelines is in the best interest of the American public, taking place as soon as possible, to prevent more people from becoming ill. A person doesn't know they have this sensitivity until it starts. It usually isn't one or two devices which cause this sensitivity and subsequent lifelong illness, but one or two too many. I urge the FCC to act now to protect Americans' health by lowering exposure limits to Radio Frequency electromagnetic fields.

Respectfully submitted by

Cindy Bowman

P.O. Box 222

Bloomery, WV

September 3, 2013

Radiation Sickness; Sue Martin Comments, Sep. 3, 2013

Please reconsider your standards of permissible radio frequency (RF) exposure limits. I am in the small minority of electrically hypersensitive people at this time, but I am concerned about other people as well. As more cell phone towers are installed and more wireless devices are used, it's hard to say what will happen to the rest of the population. In 2012, Alaska a man won a court case against AT&T for damage because of non-thermal RF exposure at work during an accident. He has neurological damage. <http://www.lbagroup.com/blog/alaska-supreme-court-upholds-award-for-rf-radiation-injury-below-thermal-exposure-level/>

I experience many different types of symptoms when exposed to RF. Most are debilitating. It has become necessary for me to search for land to buy that has less RF in order to feel human again.

Some of the symptoms are: Extreme fatigue, the feeling that gravity has greatly increased, causing the sensation of compression on my body, nausea, brain fog, changes in handwriting, memory loss, asphasia, insomnia, tingling and a feeling of vibration throughout my whole body.

I'm greatly restricted in the following because of effects of wifi, cell phones, and cell phone towers.

Shopping - almost all shopping is now done online.

Visiting family - Every one has wifi and cell phones.

Traveling - motels and airports have wifi.

Camping - most campsites have wifi.

Here is one study that shows a link to brain affects from using cell phones.

<http://rense.com/general26/2yrs.htm>

Radiation Sickness; Richard Gaul Comments, Sep. 3, 2013

I am writing you to please update your Wifi, radio wave, or radiofrequency radiation maximum outputs. We are long overdue for regulations to lower the maximum amounts any telecom towers or any other item that puts out radio wave pollution. This type of radiation is killing us. Similar to a microwave it fries you, your cells and DNA. It affects fast growing cells the most like a fetus, newborn, kids and on the way up. The elderly are learning they are more sensitive to radio wave pollution than other as well. There are just so many people be diagnosed with hypersensitivity to radio waves that we need to lower the radiation limits substantially. The FCC needs to take a serious look at the BioInitiative Report (see <http://www.bioinitiative.org/>). The leading country that has decent regulations is Switzerland. The FCC needs to study how the Swiss have transformed into the leading country that protects themselves from radio frequency intensity. The Swiss have at 950 Mhz a safe level of 4 V/m or 0.04 W/m² and at 1850Mhz 6 V/m or 0.1 W/m² safe level. The FCC levels are more than 10 times the Swiss safe limits. With so many environmental issues that get pushed on us and don't matter, we need an environmental issue like this that does matter to be fixed and legal safe limits lowered more than 10 times similar to Switzerland. There is just too much mounting evidence of biological damage from radiofrequency radiation not to adjust the levels to safe levels. As they are now, they are NOT SAFE LEVELS. I cannot go anywhere it seems without being bombarded by this serious pollution. It is killing our kids in schools (The FCC should ban wifi and Smart meters from Schools were kids are), I have it a work where all the computers are communicating by wifi, cell phones and their powerful towers are radiating us, now smart appliances are being forced on use with harmful wifi. It is the FCC's job is to protect us. It is everyones world to enjoy and not just a vehicle for the telecom's to make a fortune off of our suffering and degradation of health. Please consider what the Swiss have done and lets follow their lead and move the planet toward a safer radio frequency level here in the U.S. of A. Thanks

Radiation Sickness; Karen Strode Comments, Sep. 4, 2013

Comments on Notice of Inquiry, ET Docket No. 13-84

September 2, 2013

I have been physically injured by RF radiation that complies with current exposure limits.

It took me two years to deduce that the cordless phone, wi-fi and the cell phones that my family and I used in our home over the period of several years caused the extreme head and neck pain I had been experiencing during this time. We have removed all wireless technology and installed hard wired connections in our home. I do not allow cellphones in my home and so far we've successfully dodged getting a smart meter (although my utility company is pursuing us and we may have to move house). My symptoms are greatly reduced in this new environment. However, I am severely sensitized to RF radiation and now am electrically hypersensitive. This diagnosis was confirmed by my Allergy and Environmental physician*, Dr. Gerald Natzke DO, of Flint, Michigan.

I now work most of my hours at home due to the presence of 30 plus cell phones that my colleagues use in the office. If it had not been for an understanding boss I would have lost my employment. I am unable to use any form of public transportation due to the wi-fi that is now prevalent on planes, trains and buses. I cannot travel in other peoples' automobiles that have bluetooth or other technology that produces high amounts of EMFs.

I cannot visit friends or relatives that have a smart meter on their home, as I immediately experience excruciating head and neck pain due to the RF and dirty electricity from these devices. I do not attend social events due to the cell phone radiation and wifi. I have to restrict the time I spend in businesses or other venues that are near cell phone towers. I am no longer able to use the post office, restaurants, or other businesses that have a radio transmitter tower on the roof of their buildings. I cannot attend services or concerts at churches that use their steeples as cell phone broadcast towers.

I urge the FCC to examine the scientific studies performed by *independent* researchers (not studies done by and paid for by industry) and **lower the exposure limits!** Basing exposure limits on a single exposure that attains thermal effects is "stone age" science!

Karen Strobe, RPh

Michigan

kmstrobe@comcast.net

*Physician documentation available upon request.

Radiation Sickness; Jaime Schunkewitz Comments, Sep. 3, 2013

Comments on Notice of Inquiry, ET Docket No. 13-84

Standards for human exposure to radio frequency radiation should be more restrictive. My life has been ruined by a severe case of electromagnetic hypersensitivity (EHS). I get a severe headache, chest pains, tinnitus, ear pain, and eventually flu-like symptoms from exposure to low frequency 60 Hz all the way to RF. Cell phones cause an accute, immediate reaction which lasts for days, or weeks depending on the length and strength of exposure. I was injured by using a cell phone and CRT monitors. Your current standards are primitive and based on the rise in temperature of a rats ass after just a few minutes of exposure. Meawhile you permit children to be irradiated in schools for hours on end. I'm an electrical and biomedical engineer, not some delusional freak. I won't go down without a fight when you thugs come to my house and try to install a wireless smart meter. A smart meter is a threat to my existence. Your standards must be lowered by at least a thousands times. EHS is a world-wide epidemic, and the FCC is directly culpable for devastating a good percentage of the population.

Jaime Schunkewitz

Radiation Sickness; Linda Bruce Comments, Aug. 13, 2013

August 13, 2013

DEAR FEDERAL COMMUNICATION COMMISSION:

I understand that you are examining your current limits for radio frequency radiation to determine whether regulations should be more restrictive, less restrictive, or remain the same.

My emphatic endorsement is to make regulations far, far, far more restrictive.

Why? Because my health, your health, our children's health and their children's health is at stake.

This time, right now, is a critical juncture for all Americans and for people around the globe and for the plants and animals we depend upon for sustaining our lives.

Please use compassionate reason. Please lower the limits of radio frequency radiation.

There are innumerable sources showing that we must radically curtail the many sources of pollution on Earth—and **electromagnetic pollution, including wireless, is possibly the most grave of all pollution.**

I learned this through experience. **In 2009, I was diagnosed with a condition I had not heard of before: electrical hypersensitivity (EHS).** I felt extremely uncomfortable around electrical/radiation sources, including cell phones, wifi fields, computers, halogen lights, refrigerators, fans and much more. I had to take a leave of absence from my computer job, even after purchasing five new computers, hoping to find one that I was not sensitive to so that I could continue working.

In trying to get well, I found a plethora of information about electrical pollution and related health issues. I learned that electrical hypersensitivity has been known to the *World Health Organization* for a number of years, and that some countries, like Sweden, provide assistance to EHS citizens.

Getting my health back cost me roughly \$25,000. It took several years. Some issues are still not resolved because it is impossible in a U.S. city to not be exposed to radio frequency radiation and electrical pollution. In fact, most people with electrical hypersensitivity do not get well. They can't limit exposure to wireless sources, and they don't have access to medical treatment and they don't have deep pockets. Living with electrical sensitivity leads to depression and a sense of powerlessness.

So this is why I write to you. **Electrical hypersensitivity is just one of many, many impacts of radio frequency radiation and electrical pollution.** I hope that you and Members of Congress will be able to learn more about it.

- I highly recommend this website: <http://www.electricsense.com>
- Insights on FCC Safety Limits for Electric Fields, Magnetic Fields & RF Radiation: <http://www.electricsense.com/5029/fcc-safety-limits-for-electric-fields-magnetic-fields-rf-radiation/>

Thank you for reading my letter and for considering the many benefits—the imperatives, I feel—of taking courageous and urgently-needed action to reduce radio frequency radiation.

Sincerely,

Linda Bruce
12401 Westmore Court, Bowie, Maryland 20715

EMF SUPPORT AND INFORMATION WEBSITES (from Lloyd Burrell's [ElecricSense](#) website)

- [Abracecel: Brazil](#) : support group in Brazil on EMFs
- [Alliance for Irish Radiation Protection](#) : Radiation protection group in Ireland
- [Antenas Agui NAO](#) : Portuguese EMF support group
- [Ban the Tower](#) : New Zealand based group protesting about cell phone towers
- [Bioinitiative Report](#) : A body dedicated to providing a rationale for a biologically-based Public Exposure Standard for electromagnetic fields
- [Clean Energy Foundation Canada](#) : Canada based activist group
- [CFL Impact](#) : An information site on compact fluorescent light bulbs
- [Citizens Against Un-Safe Emissions](#) : Canada based cell tower protest group C.A.U.S.E.
- [Citizens for Safe Technology Canada](#) : Canadian based non profit making group to raise awareness on electropollution
- [Dr Devra Davies](#) : American researcher's website on EMFs
- [EHS-Action](#) : Website in French by electrically-sensitive person with information on EMF dangers and solutions
- [Electrosensitivity UK](#) : UK support group for people who are electrosensitive
- [Electro-sensitivesupportgroup](#) : Esser support group in the UK for electrosensitives
- [EMFacts Consultancy](#) : News information service on electromagnetic field dangers based in Australia
- [EMFhelp](#) : Australian website on EMF detection, prevention and remediation.
- [Emf.pt](#) : News and information in Portugese on electromagnetic radiation and health.
- [EMF Services](#) : EMF site assessment surveys, field reduction services, and building design consultation based in California and Florida.
- [Emf Safe](#) : Australian EMF radiation safety website.
- [EM Radiation Reasearch Trust UK](#) : presents research on electromagnetic radiation
- [Folkets-stralevern.no](#) : The People's Radiation Protection of Norway is an independent organization that passes on knowledge and facts about dangerous radiation in Norwegian.
- [Low EMF Office](#) : based in Italy proposes solutions for low electromagnetic emissions office equipment
- [Magda Havas](#) : Research to inform the public about the hazards of modern electrical technology
- [Mast Sanity](#) : A national organization opposing the insensitive siting of mobile phone and Tetra masts in the UK

- [Microwave News](#) : one of the most authoritative and highly regarded websites on the health and environmental impacts of electromagnetic fields.
- [Norad4u.com](#) a website based in Israel created by someone who is electrically sensitive.
- [Stopsmartmeters.wordpress.com](#) : a US based action group providing activism consultation and advice to people concerned about smart meters
- [Stopumts](#) : a Dutch website which talks about the dangers of wireless technology
- [Stralingsarmvlaanderen](#) : a Belgian website in Dutch to bring awareness about the dangers of electrosmog
- [Next-Up.org](#) : A French group which brings awareness on the EMF issue
- [Weep Initiative](#) : A body set up to inform the Canadian public about the potential environmental effects associated with different forms of electric and electromagnetic pollution

Radiation Sickness; Louise Kiehl Stanphill Reply Comments,
Feb. 19, 2013

FCC 12-152

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Notice of Proposed Rulemaking)	
18 FCC Rcd 13187, 13188 ¶1 (2003)	)	ET Docket No. 03-137
)	
And)	
)	
Service Rules for the Advanced Wireless Services	)	WT Docket No. 12-357
H Block---Implementing Section 6401 of the)	
Middle Class Tax Relief and Job Creation Act of)	
2012 Related to the 1915-1920 MHz and)	
1995-2000 MHz Bands ¶53 footnote 95)	

To: Office of the Secretary
Federal Communications Commission
Washington, DC 20554

Reply Filed by: Louise Kiehl Stanphill
3727 Hennessy Place
Santa Rosa, CA 95403
blindman@sonic.net
707-573-9056

February 16, 2013

AFFIDAVIT OF LOUISE KIEHL STANPHILL

State of California]

Sonoma County]

I, LOUISE KIEHL STANPHILL, attest that my statements are true to the best of my knowledge.

Comment round for ET Docket No. 03-137 and WT Docket No. 12-357.

1. My name is LOUISE KIEHL STANPHILL. My address is 3727 Hennessy Place, Santa Rosa, CA 95403.
2. I am a small business owner selling window coverings and cleaning blinds since 1995.
3. In 2009, I suffered a severe electrical shock to my head while talking on a cell phone plugged into a wall socket.
4. Since that event, I have become hypersensitive to electromagnetic fields and suffer great physical pain when near wireless devices including cell phones, cell phone towers, cordless phones, wireless routers and wireless utility meters ("Smart Meters"); many electronics including household appliances, computers and television screens; and fluorescent lighting, especially compact fluorescent lights (CFL's).
5. The proliferation of wireless technology has excluded me from activities of daily living, including worshiping, travelling, attending public activities and events, shopping, etc., and has ruined my functional ability to work.
6. The FCC has a duty to protect the public health and safety from harmful levels of radio frequency radiation.
7. To protect the public health, the FCC must update its RF safety regulations and base them on biologically-based safety levels.

8. In 2011, the World Health Organization declared electromagnetic radiation a class 2B carcinogen, and some of the scientists on the WHO committee not affiliated with the telecom industry felt the research easily supported making it a 2A carcinogen.

9. The Bioinitiative Report of 2012 urgently calls for greater protection from RF emissions for sensitive populations. (See <http://www.bioinitiative.org/conclusions>) “Safety standards for sensitive populations will more likely need to be set at lower levels than for healthy adult populations. Sensitive populations include the developing fetus, the infant, children, the elderly, those with pre-existing chronic diseases, and those with developed electrical sensitivity (EHS).”

Respectfully submitted by

Louise Kiehl Stanphill
3727 Hennessy Place
Santa Rosa, CA 95403
February 16, 2013

Radiation Sickness; Diana LeRoss Comments, Feb. 7, 2013

FCC 12-152

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Notice of Proposed Rulemaking)	
18 FCC Rcd 13187, 13188 ¶1 (2003)	)	ET Docket No. 03-137
)	
And)	
)	
Service Rules for the Advanced Wireless Services	)	WT Docket No. 12-357
H Block---Implementing Section 6401 of the)	
Middle Class Tax Relief and Job Creation Act of)	
2012 Related to the 1915-1920 MHz and)	
1995-2000 MHz Bands ¶53 footnote 95)	

To: Office of the Secretary
Federal Communications Commission
Washington, DC 20554

Comment Filed by: (Name . . .)
(Street or P.O. Box . . .)
(City State ZIP Code)
(E-mail . . .)
(Telephone Number)

February 4, 2013

AFFIDAVIT OF Diana LeRoss

State of Washington]

King County]

I, Diana LeRoss, attest that my statements are true to the best of my knowledge.

Comment round for ET Docket No. 03-137 and WT Docket No. 12-357.

1. My name is Diana LeRoss. My address is 116 Fairview Ave NE #930, Seattle, WA 98109.
2. I am a technical writer/editor and project manager.
3. I am hypersensitive to electromagnetic radiation. Approximately seven years ago, I began experiencing skin and nervous system problems. I had a cordless phone, a cell phone, and a wireless modem. I had no idea of the risks posed by these devices to my health. When I measured the EMR emitted by these devices, the readings were greater than 2,000 microwatts/m² for each of these devices. I must stay away from these devices in order to stay healthy. As well, my sensitivity increased to include fluorescent lights. If I use a cell phone for more than a few minutes, my skin burns. In order to use my computer, I must use an anti-radiation screen (3M now sells these). When I am exposed to fluorescent lights, I become nervous and anxious. I would be happy to discuss this with interested parties.
4. Dozens of scientific studies have shown negative impacts of EMR on human health, even at low levels of exposure. The most commonly accepted guidelines are the Building Biology recommendations that list 1,000 microwatts/m² as the threshold for “extreme concern” (http://www.baubiologie.de/downloads/english/richtwerte_2008_englisch.pdf). On May 31, 2011, the World Health Organization's International Agency for Research on Cancer (IARC) classified radiofrequency fields as “possibly carcinogenic to humans.” The FCC does not use biologically determined guidelines that affect health, but rather uses a standard that measures thermal heating of biological tissue. The premise that there are no adverse impacts of EMR on the human body until it is cooked is

completely ridiculous.

5. I urge the FCC to adopt new RF safety guidelines that take into account published research on the biological effects brought on by the ability of RF signals to communicate with living tissue, and more specifically, to consider the Building Biology guidelines for human health.

Respectfully submitted by

Diana LeRoss

116 Fairview Ave N. #930

Seattle WA 98109

February 4, 2013

Radiation Sickness; Marc Sanzotta Comments, Jun. 17, 2013

How does it feel to be radiated 24/7 by RF/Microwaves & be forced to move from my home of 28 years?

DEVASTATING & FRAUGHT WITH ALL MANNER OF HARSHIPS!

How does it feel after 28 years of living in my home to have 3 towers or masts within 1 sq. mile of my home, & two of the three less than 1600 feet away?

HEADACHES, EYE PAIN & DETERIORATION OF MY VISION, BALANCE ISSUES, HEART IRREGULARITIES, SHORT TERM MEMORY ISSUES, RINGING IN MY EARS & FATIGUE ALL WITHIN THE LAST 12 MONTHS & CONCURRENT WITH THE PLACEMENT & INCREASED EMISSIONS COMING FROM THESE 3 TOWERS.

How does it feel to know that the medical establishment has not been informed by the government concerning the health hazards of RF/MW exposure, nor has it been given the authority by the AMA to diagnose EHS (Electro-Hypersensitivity)?

FRUSTRATING AT BEST!

How does it feel to have no say in the advance of a technology which as far back as 1976 was revealed to be a lethal treat to human health by the U.S. Navy & U.S. Army, & is currently being reinforced & intensified by BioInitiative scientists' research as seen in the 2007 & 2012 reports? Or, how does it feel to know that the I.A.R.C. of the WHO has classified this technology as a 2b human carcinogen placing it on an equal level of danger as living under high tension wires?

PROFOUND GRIEF & HELPLESSNESS!

How does it feel to have a government & FCC that is backing aggressively protecting the telecommunications industry & is using out-dated & bogus methods for determining the safety of wireless RF technology, including wireless routers, cell phones, smart

meters? How does it feel to know that they are also covering almost every square foot of the earth with radiation from the cell phone towers (masts) that have no limits & no restrictions or regulations on the number of packages & frequencies that can be utilized on each mast exponentially increasing the dangerous RF/Microwave emissions? And what to say for all of the forced use of wireless routers, laptops & smart phones in our communities by an uninformed & unsuspecting public?

TERRIFYING!

How does it feel to have the only known forum to lodge my concerns (the FCC open-docket) be like finding a needle-in-a-haystack because the FCC & Media do not think that it is important to widely & continually inform the public that it exists?

I FEEL THAT IT IS ABSOLUTELY IRRESPONSIBLE & A DERELICTION OF THEIR DUTY!

This is not an isolated/rare complaint that I am lodging. I have family members & friends who suffer from EHS. Many cannot escape their plight. I am deeply concerned about their & my futures.

WE NEED & MUST BE HEARD & INCLUDED IN THE FABRIC OF THIS NATION, AS IT IS OUR BIRTHRIGHT TO BE, AS AMERICAN CITIZENS. “RADIATION WITHOUT REPRESENTATION” IS A SERIOUS BREACH OF OUR NATION’S CONSTITUTIONAL GUARANTEES. WE DEMAND THAT THE FCC ESTABLISH UNBIASED & SCIENTIFIC STANDARDS FOR THE SAFE USE OF THIS VERY VOLATILE & CONTROVERSIAL TECHNOLOGY.

I respectfully submit this to the FCC open-docket for consideration & posting.

Marc Sanzotta

Radiation Sickness; Barbara A. Savoie Comments, Aug. 11, 2016

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Proceedings
GN 14-177
ET 13-84Name of Filer Barbara A Savoie
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Date Received Aug 11, 2016
Address 1194 Lexa Lane
City Flint
ZIP 48507

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State MI

Brief Comment

5G Spectrum Frontiers is a devastation too Our Health As of today, 8-11-2016, I have been zapped by RF radiation 3 times this week. It happened once in my neurologist's office, once in church and this morning at my neighbors. When I was at my doctor's office last week, I measured the RF with my meter and of course it was high with all the cell phones people had in there. After spending about 45 minutes at the doctors, I came home with a headache, hurting eyes, lack of concentration and chronic fatigue...and I do mean chronic fatigue. I could not get up from my chair the rest of the day as I had no energy and felt like a rag. I went to church on Sunday and they always announce at the beginning of Mass to shut cell phones off. If I hadn't stood in a crowd after Mass conversing, I probably would have been all right. Someone in that crowd must have had a cell phone turned on as I got the very same symptoms I had at the doctor's office, plus belching that lasted a long time which a doctor told me is due to my autonomic nervous system. Then this morning my power was out when I woke up. I went over to my neighbors as they have an automatic generator and I saw a light on in their house. I used their phone to call my son for help with my generator. The Mrs. offered me a cup of coffee and so I stayed and visited with them for about an hour. I was sitting about 10 feet from a smart meter which was just outside the room where we sat. I came home with the same symptoms I had with the other two episodes –hurting eyes, headache, lack of concentration and severe chronic fatigue. If ill health at “non-thermal” levels was discovered among radio and radar workers in the 1930's, and Russia accepted ill health from “non-thermal” levels in 1958 which caused it to set much lower thermal levels than the UK, and the US National Academy of Sciences ' NRC accepted “non-thermal” effects in 1986, what makes anyone think the ill effects would be any less today then back then when there was even less radiation.

Radiation Sickness; R. Kay Clark Comments, Jul. 13, 2016

Today is July 13, 2016 - R. Kay Clark - Journal, April 17-30, 2014

I finally learned what I had been experiencing had a name, it's called Electromagnetic Hypersensitivity. I began to keep a journal of how it was affecting me and my life. Some days I want to die it hurts so bad and there's no getting away from it. It being the burning, shocking, prickly feeling, burning/itching eyes and other painful symptoms. There is profanity but those are times when I could not stand the pain and torture. My journaling continues today and the EMHS gets worse and worse.

My journal is handwritten and transcribed later as I was able to tolerate sitting here at my computer.

I hope at least some of this gets read and something happens that 5G either is not allowed to happen or is very strictly controlled. I am not financially equipped to do more than I've done to protect myself from EMFs and the protection I've tried is not working.

Start of journal:

April 17, 2014, 10:31 a.m. - I'm feeling kind of punk today. I hurt when I walk up the steps and I have the humming in my right ear. I'm tired. It's going to rain soon. Look for:

- copper knitting needles and crochet hooks
- copper chain
- moccasins.

I don't know but I kind of feel nauseas but not quite. UPS is to deliver the copper bracelets today and the moccasins tomorrow. I'm being shocked a little bit by my Kindle and my mouse. My nose is starting to itch but I'm sitting at my computer monitor and that's usually when it happens. Actually it happens anywhere, the nose itching.

5:56 p.m. - It's been a crappy day. Copper bracelets came. I put them on right away but it didn't make any difference. I've had the feeling all day that feels like tiny little wires poking into my skin. Sometimes the feeling feels like it comes and goes and other times when it starts it feels like it will never stop. My nose has ran today. I've sneezed. In fact I've sneezed every day for a long time now.

Around 8:00 p.m. - ordered pizza earlier. I don't have food except peanut butter and rice drink and I'm hungry. The humming sound in my right ear is so annoying. (Book - *Riding the Waves: Diagnosing, Treating and Living with EMF Sensitivity*, Maxim, Elizabeth (2010-07-27). Kindle Edition.) At this point is when I began learning I had become hyper sensitive to electromagnetic fields and after

April 18, 2014, 11:46 a.m. - I feel really good today. Yesterday I was miserable all day long. When I took all the bracelets and watch off, my wrists itched and they were very red and of course green. I washed them really good and they felt better. Today I have only one bracelet on. Started yesterday, I made some changes -- I put a six-plug wall plug in the living room electrical outlet where there was a power strip. I took that power strip and put it in the office. There were six plug-ins in that strip where the one that I had been using had twice that many plug-ins and six were empty. I read somewhere that power leaks from power strips when some of the plug-ins weren't used. Then in the kitchen I removed that power strip and plugged the grow light directly into the electrical outlet like it had been prior. The only reason I used a power strip was because I could turn the light off at the strip. The strip had five or six plug-ins so that left five opened maybe leaking electricity. This morning I was bothered a little bit by my mouse.

April 19, 2014, 11:02 a.m. - My head started hurting yesterday, late afternoon and today it still hurts. Not really a headache. It might be from my back (pinched nerve) because if I tilt my head to the left and stretch my neck that makes it hurt down in the upper part of my back. I think I need the electric company out here to remove the thermostat. (It's a programmable thermostat and the electric company can manipulate the temperature from their facility. It's been installed since August 2009.) Asking to have it removed because as I'm sitting here knitting I get the stinging, prickly feeling in my arms and hands but not constant. Except for getting a new bed, I've run out of things to change to make a difference in the EMS symptoms I'm experiencing. It's wearing me down. It could be sitting in this recliner causes the symptoms because the fabric is synthetic and there's metal also. I think all this money I'm having to spend on things to bring my living more comfortable health-wise should be tax deductible. I know I'm sensitive to electromagnetic frequencies and I don't need a doctor to tell me so. Anyway, what I'm experiencing hasn't been recognized as a health issue but I will goddamn say it is, I just wouldn't go to a doctor about it. Twice I've had vaginal break-through bleeding since -- well, in the last 12 months. I have insomnia and the last few nights I haven't been able to sleep in my bed because of the shocking, prickly sensations. Right now, today, and for the past couple of days there has been loud humming in my right ear, ringing and hissing in both ears and diminished hearing. I need to get groceries (more protein). I hate grocery shopping. Anyway, I'm down to rice and beans and peanut butter.

April 20, 2014, 4:46 a.m. - I slept okay last night, on the couch again. I'm so leery of going back to my bed. I should try taking the headboard off.

April 21, 2014, - I finally ended up sleeping in my recliner last night and I guess I slept very good because I didn't wake up until around 5:30 a.m. P wanted attention! I should go get groceries today because I have no food! I was going to

have the electric company come out and take out the programmable thermostat they installed in 2009 but changed my mind. I'll wait until someone is here to help me move the couch and I'll move the recliner to the corner where the couch is now. M messaged me and she's going to call today. *By the Weather Underground records it rained/thunderstorm today or rain/thunderstorm was predicted.*

April 22, 2014, 4:44 a.m. - I was tired and sleepy and I got ready to go to sleep. I started in my recliner and not long after I was settle the creepy crawly sensation started in my hands and arms mostly. So I got up and moved over to the couch -- same thing. Now sometimes when I get the shock feeling that spot where it happens hurts for a bit afterwards. So, finally I went outside and stood on the patio. I did put my feet in the grass for a second or so but not being sure what was on the ground I didn't stay in the grass long. When I came back in and laid down on the couch I was finally able to go to sleep. (after 10:00 p.m.) Kind of seems like I had a couple prickly feelings but now I'm not sure. My hair is a mess and I wish I would cut it myself. L called yesterday and my car needs a new transmission and not worth the money. I've got to call for a cab and go get groceries today. (It was around this time I was reading the book, *Earthing: The Most Important Health Discovery Ever?*, by Clinton Ober, Stephen T. Sinatra, Martin Zucker.)

April 23, 2014, 10:41 a.m. - The last couple of days I had this roaring in my head and my blood pressure was higher than is normal for me and I lost hearing in my right ear. Today the roaring is gone. It's raining. I feel pretty good today so far. I wanted to go out and sit on the patio and put my feet in the grass but it's been raining. Maybe it will stop and I can still do it. I'm being shocked (burned) by my mouse -- all day today -- when I was at my computer, keyboard, too. Guy working on gas meter - 1 p.m. or thereabout, says regular maintenance. (I questioned that later). Terrible, miserable evening. *By the Weather Underground records it rained/thunderstorm today or rain/thunderstorm was predicted.*

April 24, 2014, 2:00 a.m. - I was awake earlier, around 9:00 p.m., got up, went to the bathroom. I tried to go back to sleep but wasn't able to. Played Solitaire for awhile, laid back down. Not sure I really went back to sleep. The shocking or stinging started. So, before it really started pissing me off I just got up.

2:58 a.m. - I'm sitting here at the kitchen table and I was feeling miserable. I'm trying to read "Earthing". My eyes were feeling itchy and of course my arms and hands. I looked at my Kindle, which I'm sitting right in front of, a tiny bit more than an arm's length away. I wondered, even though it's not turned on, could it be causing some of this (my EMS). So, I laid it screen down on a folded washcloth and at least the shitty feeling to my eyes and face stopped immediately. I need to search for protective screens for Kindle, mouse and keyboard.

Some Notes: ESD = electrostatic discharge (computer towers are grounded, so why do

I need to wrap my computer tower with the sheeting? (Bedroom, in the book, registered highest, EMF) Society for Barefoot Living. These Notes are from reading Earthing.) I'm still feeling some symptoms but nothing like before I turned my Kindle over. So just now I turned it completely off.

Around 3:30 a.m. Okay! It's 3:43 a.m. and all the itchy, prickly and shocking symptoms have stopped. My Kindle is completely off and is screen down. (I question that that made the difference.)

Note: At the moment I don't recall where I read this: (*grounding sheet - primitive Metalized duct tape/used for furnace ducting, laid tape on bed to form a crude kind of grid, alligator clip attached to end (one) of duct tape, connected a wire to it, ran wire out window, fastened to ground rod.*) This was just part of my journaling and maybe later I'll be able to recall where it came from, possibly from the book, "Earthing". Along with this note I've noted ESD (site online). Note sure what that means.

April 24, 2014, 5:45 a.m. - I just got up after going back and laying down around -- maybe it was between 3:00 and 4:00 a.m. Never did go to sleep and I am so tired and I'm weary from this (these) horrible sensations. I would try the duct tape thing but I don't know any way to ground. Since the symptoms are worse now at the south side of the living room, actually the southeast corner, I wonder if the MGE guy put in a smart meter instead of doing maintenance as he said he was doing. It really is coincidental that the sensations or symptoms started again at the time of MGE visit.

I have the watch on w/the stainless steel back and band, a copper bracelet and they are doing absolutely nothing. In fact, twice now I've felt little sharp (shocks) from both of them. When I first read about the copper bracelets and how they worked for the author, then I bought three, I already had one. I thought it was great how they worked for her and when I first put the one on that I already had, I thought, wow, maybe this will work for me, too, but NOT! I'm really tired and when I first sat down here, I'm at the kitchen table, I even felt a little sick to my stomach. I'm tired of reading now.

My Kindle is shut down, my computer and peripherals are completely off, even completely unplugged and my cell is completely turned off as is the TV, etc. and unplugged. Still I'm being shocked and that creepy feeling of stuff creeping along my skin, also being shocked and tingly, prickly feeling. I'm miserable and tired. (Yesterday was such a pleasant day with virtually no symptoms) and now it sucks! I wish I could go to sleep. It's going to rain/storm.

I can't sleep in my bed, nor on the couch or in the recliner without getting shocked.

About 20 minutes till 8:00 a.m. I sat in my recliner and tried watching TV and I was so miserable and so tired. I shut off the TV, unplugged everything, pulled

the thermostat out of the wall mount. Nothing helped. I tried sleeping and maybe I went to sleep, I don't know. The symptoms were still happening when I got out of my recliner at about 9:00 a.m. I went to the bathroom and then outside to check what MGE had done with the meter. Its dials not digital if that means anything.

I looked at the tenant's side and the guttering is leaking at the end of the gutter, not the downspout. (I went over to look at the gas meter on that side and that gas meter doesn't have the red screw-like things on the meter like the new meter the gas service guy installed on my gas meter. (That's a lot of meters!) I don't know what that means.

It's been raining ever since before 7:00 a.m. I don't recall ever feeling so horrible "while" it's raining. It's usually a day or a few days before it rains I feel bad. I keep smelling something that smells like liquid laundry detergent and it's rather strong. Sometimes I think there's something really wrong with this new sewer system. That smell and no sleep and the shocking and prickly, itchy feeling is making me nauseous.

You know, I sit here pretty much minding my own business and all this fucking shit is happening to me. And like caring for H. and those fucking B.s harassing me while I'm there and the shit they did to me while I was caring for W, et al. And all the other shit people have done to me or against me. It sucks! Then feeling that no one, I mean no one, cares about me.

I can't believe how good I felt yesterday and today is horrible.

I ordered the body bands from www.earthinginstitute.com today. I don't know when they'll be delivered.

I went outside earlier to look at the gas meter. Then later I went online to see if gas meters can have Smart Meters and sure enough there was the exact meter that's now installed at my home. I didn't receive "anything" asking my permission or allowing me to opt-out. I've not only been sick all day and most of last night but now I'm fucking furious.

Note: Environmental electric fields

I went to bed around 7:00 p.m. I sure wished I could have gone to sleep but about 7:25 p.m. the stinging, prickly, shocking feelings started. I had removed the headboard, which was metal. There was the Himalayan salt lamp, the sound machine, two lamps and the bug deterrent plug-in in the bedroom, if that made the difference.

I am so tired. Also, it feels like no one cares. I called R and I wasn't surprised no one answered, nor that no call back. Didn't hear back from T after sending him two email, one a thank you and the other asking for help with a letter I was writing.

That roaring sound in my head is back.

While sitting in the living room before going to bed because I couldn't stand it any longer in the living room I was being shocked like crazy. It's been bad before but not this bad.

There is just really no place now I can go inside here where I can get away from this horrible thing that is happening to my body. Oh, yeah, while I was sitting in my recliner in the living room I had this horrible pain in my left side of my head.

For years I have experienced certain shocking and burning like symptoms and only this year, 2014, did I finally think I've learned what is causing those-these symptoms.

It was April, I came across the book, Riding the Waves: Diagnosing, Treating EMF Sensitivity by Elizabeth Maxim, Phd. Although reading about what worked for her did not work for me, I did learn of other books available about EMF (electromagnetic frequencies/fields). I believe it was from Maxim's book I learned about the book, Dirty Electricity, by Samuel Milham, MD MPH. If it wasn't Maxim's book I learned about Milham's, her book was the beginning of my education about electromagnetic frequencies (EMF).

I believe it was around or 2007 I began experiencing EMF symptoms. I had no idea what was happening to me. I didn't know who to ask about my symptoms. I was embarrassed about it, also.

Since I've been reading about electromagnetic frequencies, electromagnetic sensitivity and electromagnetic hyper-sensitivity, I believe that's what I'm experiencing. I've tried some solutions, of which none have worked. Maybe they have helped to lessen the sensitivities a bit.

My biggest problem now is using my Kindle Fire, my computer mouse and keyboard. When I use any of those three devices I get shocked or burning-like sensations.

I have unplugged my wired modem, changed my wireless mouse to a wired mouse and making those changes didn't make any difference.

I had begun searching online about what I was experiencing but never entered the right search information until April, this year, and I found lots of links about electromagnetic frequencies and sensitivities.

Coupled with the EMF sensitivity, my symptoms get worse around the time the weather is about to change or during inclement weather.

During my learning process about electromagnetic frequencies and radio frequencies I came across geoengineering. As I started reading about geoengineering I began to wonder if I'm also sensitive to the chemicals being sprayed into our atmosphere. (Miserable . . .

Is that possible, that I'm sensitive to EMF/RF and that the chemicals in the atmosphere from geoengineering or climate engineering compounds my sensitivities?

April 25, 2014, 8:40 a.m. - I can't believe I'm still here! (Maybe a little extreme.) It rained a lot yesterday and usually during the rainy time I feel pretty good. But yesterday I felt all the symptoms I've described before and not having adequate sleep the night before, I was totally exhausted. I had washed three loads of laundry, which included bedding. Before I got ready to make my bed, I took the headboard off. Then made the bed and was really looking forward to crawling in between the nice clean sheets and falling asleep. -- Didn't happen. I was in bed about 25 minutes and the symptoms started to rev up. (Most of the day the salt lamp was on and still on at bedtime.) Anyway, I was fairly certain the symptoms weren't going to go away. I got up, took the mattress off the futon and proceeded to make my bed on the mattress on the floor. (I had already unplugged my computer, etc.)

Okay. Bed on the futon mattress wasn't a good idea. (futon frame = metal) I think I partially drifted to sleep but when I woke I felt like my head to my waist was wrapped in a heavy comforter. So, not only was I way too warm, I felt I was being smothered. I got up and was thinking, "I'm really out of choices for a place to sleep up here or the next level down. (I was in my office, which is upstairs.) So, I grabbed up my bedding and went downstairs to the TV room, which used to be my office. I made my bed on the couch and wasn't long and I was feeling the symptoms revving up again. I think I may have slept a little bit but I'm sure not restful sleep. Anyway, I think it was around 11:30 p.m. I again packed up my bedding and my last remaining choice for a sleep area was the garage. Made my bed on the carpet runner in front of the downstairs door (I'm now on the ground level of my home), using two of the cushions from the lawn chairs, plus some old blankets and my bedding. When I first laid down I thought this is probably going to be too cold and I could still feel some of the symptoms but not full-blown yet. I guess I finally went to sleep but I know off and on I would wake up a little to turn over. Then I would hear P wanting to know what I was doing down there. When I got up I was surprised to see it was about a quarter after 7:00 a.m. Since it's so dark in the garage, I thought it was still night.

Okay. I come up to the kitchen and P has knocked a bracelet, three wrist watches off the counter. Picked those up. Put food down for P, which she still hasn't eaten what I put down before. I think she's mad at me because she couldn't get in my business last night. I wanted her with me but she would have been in to everything in the garage -- All Night Long!

So, anyway. I feel only just a bit okay this morning. Still very tired and before I ate I was feeling a little queasy.

The sun is shining today. It's only 55 degrees out though. I think suppose to be in the 70s, closer to 80.

I'm sitting here at the kitchen table because I'm leary of sitting any other place. The only thing I've turned on this morning is my phone. (And of course, no one has called.)

Got a text with picture from L late yesterday afternoon and she had gotten her hair cut. She's so pretty and I liked her hair. She looked kind of sad though. I think I'll go turn on my computer and check a few things. Not going to stay on long. I'm not going to turn the TV on, maybe this evening or not at all. If I got rid of the internet and Netflix I would save but I sure would miss the internet because of all it's allowed me to learn and the entertainment.

I called the ISP, then connected the old modem but they said the old modem (hard wired) wasn't working and of course they wanted to rent me a modem. Nope, I don't think so. So, I'll leave things like they are for now.

So far today I've been fine, a couple times slight symptoms. I am very tired from yesterday. I went out to spray the weeds in the driveway. While I was out I checked the gas meter on the tenant's side. It looks like nothing has been done to it for a long time. (Doesn't look like mine and still looks the same when I checked it the last time.) The meter just west of my home has been changed to a, what I'll call a Smart Meter. Very curious!

While I'm typing this (no one would be able to read my handwritten notes) my keyboard shocks and burns my fingers and sometimes I'll get shocked on my back on the left side up by my shoulder. And of course my mouse shocks and burns my hand. No marks show on my skin but it sure as hell hurts!

April 26, 2014, 7:04 a.m. - I guess I slept okay last night. I think I went to bed between 7:00 and 8:00 p.m. I took a couple Aleve. because my right knee had been hurting. I may have wakened a few times to go to the bathroom and someone is supposed to be here today or Monday to do the gutters. Looks like it's going to be nice today, at least right now it does. Heard from T, text message. I'm glad because I was beginning to worry something may be wrong. I've had breakfast and am having coffee. I have a headache or at least my head hurts.

11:35 a.m. - I feel crappy and I don't know if it's because I'm not getting good sleep or what. My head hurts and if I'm in one place too long some of the symptoms start or increase in intensity. I've felt worse since gas company put in the Smart or Advanced Meter or that's what I'm calling it because it looks like the images I've seen online. It's now my head hurts, pretty bad some times.

I feel I should have been told by the gas company they planned to put in a Smart Meter and I should have been allowed to decline the installation.

11:45 a.m. - Right now, I'm sitting at the kitchen table and the pain in my head has let up a little. Sometimes I almost feel sick to my stomach because of my head hurting.

Note: Got book, "Dirty Electricity", a few things I learned from the book or knew before:

- EMF - electromagnetic field (and their related diseases) I don't call them diseases I call them "symptoms" of being exposed to electromagnetic fields and radio frequencies and geoengineering.
- 50- and 60-Hz = extremely low frequency (ELF)
- Part of the electromagnetic spectrum
- G/S meter for measuring electricity at outlets (which I cannot afford to buy right now)
- Plugin capacitive filter - www.stetzerelectric.com/

Comments, a couple I have right now:

- I have become hypersensitive to electromagnetic fields and dirty electricity
- I have purchased a Himalayan salt lamp, copper bracelets, many books and a number of other objects that I've read should eliminate or help reduce symptoms of electromagnetic frequencies - I've wasted my money!

April 27, 2014, 12:16 a.m. - I fucking can't go any place in my home where I can get away from being SHOCKED. I pulled the mattress off the futon again and pulled it over in the doorway so part of it was in the office and the rest of it was in the hallway. My little tiny hallway! It was some time around 7:00 p.m. I was tired so I went ahead and tried to go to sleep. It was mostly my hands, the shocking, prickly sensation and it just wouldn't stop. (Right now my eyes burn.) I finally went to sleep but was awake again some time after 9:00-9:30 p.m. Been awake ever since. Sitting here at the kitchen table, eyes burning and periodically stinging and shocking sensations. This is fucking bullshit. I have to get the electric company out here and change thermostats and hopefully the gas company back and put back the analog meter on the gas meter. When the gas company changed out the meter on the 22nd or the 23rd of this month is when the shit started getting worse (if it could get worse). I had the office window and kitchen window open all day. The office window is still open.

Before I gave up trying to go back to sleep I started coughing, a lot.

I stopped using the microwave some time the beginning of the month. Also, I've been using a folded up cotton blanket wrapped in an old cotton bath towel as a pillow. All my pillows are synthetic and I think that's a contributor to my sensitivities. My hair has gotten to be such a mess and I started thinking maybe it's the pillow, then maybe the microwave. I started using Organix (brand)

shampoo and conditioner. It was after the pillow change that my (I don't know what I meant to say here), at least to me, started to change. My fingernails were a mess all winter. They're better now but they have ridges and when they grow out a little they chip and break. I try to keep them trimmed back closely. I have little pink spots on my arms and a couple on my legs. They don't itch or hurt, nothing like that. I have one on the back of my left hand that's probably about a quarter of an inch in diameter. I keep putting coconut on it, along with a cotton ball and paper tape.

I firmly believe electricity comes right out of the electrical outlets because sitting and if I put my left leg down (right now I have both legs propped on the other chair) there will be a stinging or more like shocking/burning sensation I feel on the side of my leg facing the outlet.

12:50 a.m. - P just came down for some kitty lovin'.

My symptoms get worse a couple days or so before rain or weather change and since the gas company put in the Smart Meter I have or experience the symptoms even during rain or atmospheric changes.

In the book, "Earthing", Ober writes that some individuals are ultra-sensitive and can be severely affected by electromagnetic frequencies, (page 78). Sometimes I wonder about the grounding in my home.

And some more of my symptoms are itchy nose (terrible sometimes) and sneezing. Right now my nose itches terrible but not as bad as it has at other times. Every once in a while the back of my hand has a burning sensation. Next month I'm getting an Earthing grounding sheet.

It's 1:43 a.m. - I'm still having occasional symptoms. I want to go to bed but I know as long as the symptoms are ongoing it'll just make me agitated if I try to go to sleep.

I have heart palpitations, I think that's what it must be called. Not often but often enough I don't like it. Here lately every once in a while I'll wake up and my heart will be racing. At first I was thinking it must have been something I'd eaten but now I think it's all part of the EMHS.

My right knee, I used to blame the pain on when I was transcribing and lifting my foot up regularly using the foot peddle on the transcribing machine. This was daily for long periods of time. Now I'm not so sure. The knee pain, it's now my knee and up into my hip area.

Suggestion from book, "grounded shoes".
I hope the groundals work - ordered!

10:36 a.m. - I finally went back and laid down. It took a while but I finally went

to sleep. Ms. Kitty woke me around 4:30 a.m. or thereabout. I'm sitting at the kitchen table, had breakfast earlier, was on the computer but not very long. I tried knitting but started becoming uncomfortable, so I'm back here reading "Earthing". I just figured I've been experiencing some form (symptoms) of EMHS since 1983 or thereabout, around 31 years. It (the EMHS) didn't become a terrible bother until mid 2007 and has progressively gotten worse. I didn't even learn about electromagnetic hyper-sensitivity until this month, April 2014.

This sounds weird but sometimes, like if my hands touch the shocking symptom will occur. Other times it feels like "the shock" enters or touches one part of my body and immediately I feel that sensation in another part of my body. Sometimes I "think" the man-made electricity charges my body and that's why my hands and fingers feel like they do, the tingling, burning, stinging, shocking symptoms. I don't know, sounds crazy but I don't know how else to describe it. Some of the symptoms didn't start until after the electric company put that thermostat in my home. The thermostat can be regulated by the electric company from their location. They can do something with my air-conditioning, like cycling it during high-usage time, something like that. That was what was explained to me when the thermostat was installed. Along with the thermostat the electric company service person also put a device on my furnace. Now I wonder what other little magic they can perform through the thermostat.

Then this month it's gotten worse, the symptoms, after the gas company installed a Smart Meter or an "Advanced Meter" and they did it without any prior warning they were going to do it and without my permission. When I realized someone was at the side of my house the day the meter was installed, I went outside and asked the gas company service person if there was a problem and he said, "No, just regular maintenance." I don't call changing the meters regular maintenance. I called the gas company a few days later and ask that the gas company remove the current meter and replace it with an analog meter. The person at the gas company I had to talk to stated he didn't know what I was talking about, that there was no order for work at my residence.

Through all this learning about EMF, EMHS, RF, MWF, etc., I learned about Smart Meters and Advanced Meters. Wow, have I been a dunce! Those meters have been around a while and I knew nothing about them.

I wonder now if the labyrinthitis I experienced in 1993 or 1994 was because of EMFs. Sometimes I will have diminished hearing, usually in my right ear and usually it comes back but it's not "normal" hearing. I hear sounds differently in each ear. My left ear - when I put my hand up to my left ear and rub my thumb and finger together, I can't hear any sound at all but when I do that at my right ear I hear it clearly.

Right now the only place I'm rather comfortable is here at the kitchen table or unless I go down to the garage or outside. I know I don't go outside enough but there is absolutely no privacy out there and I feel awkward out there by myself

I've only shared what's been happening with me and what I believe it is with R. That only started in earnest this year, maybe the end of last year I shared what was happening to me because I didn't have a clue what it was.

I won't go into this now but the reasons I didn't go/haven't gone to a doctor is many reasons, the main one being I didn't know where to start with what was happening. I felt weird in that I was surely the only person it was happening to.

Additional symptoms - weight gain, bloating, gas, sleep issues, digestion, pains in different parts of my body, the worst being my right knee, allergy symptoms like runny, itchy nose, coughing and a lot of sneezing, burning eyes, some times blurred vision.

I'm extremely sensitive (hyper-sensitivity) to electromagnetic fields.

April 28, 2014, 6:13 a.m. - I was up and down all the steps yesterday, probably a total of 10 to 15 times. By the time I got my bed ready, my right knee was killing me. I pulled the futon mattress down to the living room and after positioning it three different places, the 3rd place worked. But at that point I realized the ankle support I had put on, to maybe help my knee problem, had magnets in it. So I took that off. Then the pillow I was using to support my right knee, it had a polyester pillow case -- well, the fucking pillow was, what I call, a petroleum product, so I got rid of that. Then I yanked that damn electric company's thermostat out of the wall, it's a plug-in type thermostat. Earlier I had gone down to the electrical breaker box, I was very ready to shut off the power to the whole place. I couldn't get the main breaker switch to budge. Anyway, after all my preparations I was able to finally go to sleep.

I think because all that went on yesterday, because there were storm warnings all day long, that's why the going up and down the steps so many times. I was preparing, I was wound tighter than a drum! So, today I feel little twitching-like sensations all over my body and I believe it's because I was finally able to get some quasi-quality sleep. So around 5:00 a.m., Miss Kitty came looking for attention and I got up, had breakfast. I'm still a little tired though.

Back to the sleeping. I read something in Earthing, Edie M. defined her sleeping problem *as if all the cells in her body were vibrating*. That's exactly how I've felt trying to sleep or awake, only I thought of it as being wired (highly!). See Earthing, page 148. Edie stated she had her problem for ten years. My problems (my EMS) have been for seven plus years or more and they are escalating. Edie's experience with the computer's mouse sounds like mine except my mouse would actually "burn" the palm of my hand. Keyboard, same thing. Keyboard is wired, mouse is wireless. Edie's statement, "electrical energy coming into me". Wow, I finally feel vindicated by her statement because that's exactly how it has felt to me. I almost think sometimes I can feel the electricity entering at one

point on my body and simultaneously exiting at another point.

I want to purchase two foot pads; one for me and one for P or purchase one for me and buy the pet one for Miss Kitty. I want to purchase the bed sheet and I feel the half sheet will be adequate. I've already ordered and am waiting for the bands. Also, I've ordered and am waiting for my groundals - grounded sandals.

As I stated previously, I only this month learned of "grounding" or "earthing". That's one of the biggest reasons I don't want to give up my computer because of all the things I've learned and am learning.

Other symptoms (mine)

- Confusion (or actually seems I simply stop thinking)
- Get angry and irritated easily
- Aching all over
- Loss of balance (this just started this year)
- Fatigue
- Stress (caused by me not knowing what was happening to me and my body or why it was happening)
- Incessant itching of my nose
- Head hurting, very painful
- These symptoms are in addition to others

I was in an automobile accident in 1968 and was left with a pinched nerve in my back (or so I was told). Anyway, for years my back hurt in the area of the injury. Then it, the hurting, stopped for a long time. Then it would be painful when/or just prior to changes in the weather. So at the onset or during all these symptoms I was/am experiencing I tried to make myself believe that somehow that back injury could be the culprit. Also, when I was probably about three years old, while outside playing and I was barefoot, I stepped in some glass. My parents never took me to the doctor although the cut was very deep. It was believed the glass cut through the tendon in my arch (right foot) and I'm trying to relate that horrible cut to the pain in my right leg. I think a lot about injury to the body or cutting into the body or cutting things out of the body and I really don't think nature intended for things of body to be removed. I've had my tonsils and I guess my adenoids removed, my appendix and my oviducts removed. I don't think nature actually intended for the things to be removed from our bodies, else why are they there in the first place.

I haven't had a good, uninterrupted night's sleep since prior to 1988 or thereabout.

- 4mG or milligauss, most homes measure this amount in alternating (AC) magnetic fields.
- Electromagnetic fields (EMF)
- Radio frequencies (RF)
- Radio frequency radiation (RFR)

This is an observation aside from what I've written so far, but the book I was reading, Dirty Electricity: Electrification and The Diseases of Civilization, by Samuel Milham, MD, MPH, where he talks about government, etc., page (location on Kindle 725 or 47%). I wish I would have purchased a hard copy edition. -- Anyway, US government, military, the energy companies, well, actually only the government. An uncle of mine was a state senator and he said that his last year in office he did absolutely nothing but report for work and left at the end of his workday. He said that if you're not a crook when you go into government "work" you will be when you leave. Me, I firmly believe that and with all my heart I would like to be part of a movement to change the US government for the "good" and "betterment" of "the people".

✱ What is radio frequency radiation? Look it up. (Note to me)

I didn't know when I continued reading the book I mentioned just previously but I had to stop because of EMS. My index finger was hurting/burning badly. There's metal in the pen and that makes the pain worse.

Now that I've turned my Kindle off (that's where my book is) my finger doesn't hurt. But when the pain starts, if I don't remove the object that's causing the EMS or I physically move then I have what I'll call residual pain Like right now both of my hands have a prickly (very annoying) feeling and it seems to take a while for it to dissipate.

It's 4:36 p.m., and what turned out to be a very cool, dark, overcast day. R texted me this a.m., "Call when you can talk". So I called and we talked a long time but that's not unusual. R is off for nine days.

So, I'm waiting for my earthing bands and I'm absolutely sure I will be ordering the earthing bed pad/sheet, a pad for at my computer. I may be poor by some standards but I will spend money for those things. My groundals came Saturday but I didn't get them until today. (It must have been the lazy postal person who delivered my mail Saturday because the regular postal person brings my packages to the door.) The groundals work outside! I was hoping inside but that's okay.

April 29, 2014, 11:41 a.m. - I'll write about last night later.

- Today I started taking 4 vitamin D3; 2,000 IU mini gels to see if that helps me feel any different. We'll see.

Another dark, wet, dreary day.

12:49 p.m. - I tried going to sleep and this shocking thing is horrible. Ever since the gas company put the Advanced Meter in I probably haven't slept but 2 to 3 hours a night. Right now I'm being shocked everywhere. The prickly feeling is in my legs. I'm so fucking tired I can hardly stand up, my eyes burn and hurt.

When I get shocked in my chest that is so fucking painful - so very fucking painful.

It's raining. I know it rained last night and I don't know if it ever stopped. I have to lay this pen down every few minutes because my hands tingle, have that prickly feeling and a small part of my palm feels like it's burning, the shocking hurts so bad. I'm so tired. I woke up this morning or rather finally got up between or around 5:30 and 6:00 a.m. My night was horrible.

I drug the futon mattress back down to the living room last night - didn't do any good, I just could not go to sleep because the invasion of the EMFs. Right now I really don't care to keep living. Along with all the pain and being so tired and no one seeming to care about me, I just don't care.

Last night I even came out to the kitchen table, had a blanket to wrap up in, towels and a blanket to lay . . . me held on. (Not sure what I was trying to say here.) I had already gotten dressed again. Well, all that didn't work. I finally went back, laid down on the futon mattress, rolled up in a ball, even left my moccasins on and I guess sort of slept. Some time Miss Kitty came and laid beside me.

Sometimes I wonder if the microchip in her does something or interacts with the EMFs and that has an adverse affect on me. (That's probably way out there!) I took 2 allergy tabs about an hour ago and aside from my nose stopped dripping I still feel very bad.

I can hardly wait for those bands to come. I just hold out for the hope that they will work.

I took 8,000 IU of vitamin D3 about an hour ago. I don't know if that's too much but I thought I'd read somewhere that a 10,000 dose would be helpful. I know with a certainty that the EMHS has gotten 100% worse since that (expletive) Advanced Meter was put in.

And the very, very, very loud humming on the right side of my head -- it's making me crazy.

So, from around 1:00 p.m. until about ten minutes ago (now 3:54 p.m.) something was going on in here and whatever it was it made me feel horrible, really, really horrible.

I'm going to start in earnest to move from here and so far the only place I know about where there won't be all this Smart, Advanced Meter business and electromagnetic frequencies and radio frequencies is Green Bank, West Virginia.

I just learned that if you refuse to let them install one of those Smart Meters then you have to pay a fee to have your meter read. Or if a Smart or Advanced

Meter has been installed and you ask for the, whatever it is, to be turned off, you have to pay for that, in addition you have to pay the meter reading fee every month.

Supposedly my electric usage/cost was supposed to go down when they installed the thermostat that monitored my electric usage and supposedly lower or cycled the air-conditioning. Well, my electric costs "did no" go down.

The EMFs - it's not just the ones coming from my electric meter and now the gas meter, it's everyone around me, plus computer, wifis, etc. That's why my symptoms of EMHS are always on.

April 29, 2014 - 6:17 p.m. - About 5 to 6 minutes ago, maybe 10, I went down and turned off all the breakers. I can't turn off the main breaker, the switch won't move. 7:00 p.m. - didn't do any good to turn off breakers. And the roaring, pounding in my head is worse. 9:00 p.m. - I tried sleeping in my bed - didn't work, still being shocked. Went down to the futon in the kitchen - nope, moved to living room, nope. Back in my bed and I'm still having symptoms. 11:30 p.m. - Still being shocked. It's cold in here. Miss Kitty sleeping with me. Unusual!

April 30, 2014 - Earthing order came today.

8:40 p.m. - I'm in my bed with both wrist bands on. During the day I was somewhat comfortable. After being in my bed even with the wrist bands on, I was still having the shocking feeling mostly in my hands. I got up and got in the recliner. I was finally about to go to sleep. Didn't write down time. I woke up one time during the night and it was either around 11:30 p.m. or thereabout or 1:30 a.m. I was able to go back to sleep but it took a while. It was around 7:30 a.m. when I woke up.

Radiation Sickness; Steve & Juleen Ross Comments, Sep. 3, 2013

Juleen was stricken with chemical sensitivity after exposure to a combination of formaldehyde, new building materials, pesticide, and a non-functioning ventilation system in a sick building in 1989. Seizures were her first symptom. Around the year 2009 she began having numbness in her legs and especially her feet while watching TV and fatigue after using a computer. We have intentionally banned wireless devices from our home, with the exception of a cell phone that we only use (sparingly) when one or both of us are in the car. It's clear to us that EMF sensitivity can happen to anyone, especially someone who is already sensitive (as so many people are, even they don't realize it). In light of substantial evidence of harm, as well as broad international agreement about the dangers of exposure, and despite the lobbying efforts of the telecommunications/wireless industry against any change, we believe the FCC has a moral imperative to revise and strengthen its standards and restrictions for human exposure to radio frequency radiation.

Radiation Sickness; Kathy Ging Comments, Sep. 3, 2013

PART ONE: The Problems - Ignorance and Manipulation of Information about Complex Changing WIRELESS Technologies

One sided research often funded by the very industry needing monitored is regularly cited by both corporate public relations staff and public stewards (the latter supposedly paid or elected to protect public interests not those of trans-national corporations like the telecommunications industry).

In my own experience interacting with EWEB (an electricity and water providing utility), I have witnessed grossly inadequate, partial and biased information provided to the public on its web site and by staff.

Much of the bias is due to their predisposition to favor an as yet untested digital wireless smart meter technology on a poorly informed public instead of engaging the community in an open ended debate and encouraging scholarly and journalistic research as to the pros and cons of wireless (and wired) smart meters.

EWEB staff and some board members, like many apologists for proliferating wireless technology, neglect to include corrections by Daniel Hirsch, nuclear policy analyst, University of California, Santa Cruz, who did a critique of the conclusions of the California Council on Science and Technology report on smart meters cited on EWEBs web site and other sites promoting wireless smart meters. EWEB also advises ratepayer-owners to rely on FCC guidelines which are shamefully obsolete in today's wireless world.

Putting a magnifying glass on my experience with this one utility (some of whose board members boast it to be the best utility in the nation), I can report that, under the smart meter/ advanced meter infrastructure FAQ, one question was:

Are there any issues with Radio Frequency? Initially in July, 2011, the first sentence in the answer was simply: _No._ followed by a paragraph dismissing health issues.

Shortly after staff met and interacted with members of the newly formed Families for Safe Meters (DOT.org is its web site) and medical professionals separate from the group - the _No._ sentence was deleted.

EWEB staff, board and some ratepayer-owners in the last two years have begun to climb the learning plateau to at least have enough savvy to delete the word _NO._ and to engage in some dialogue whereas in most areas dominated by Investor Owned Utilities (IOUs) the conversation has not been as civil.

The stuff of history is anecdotal stories - it is those I will discuss in PART TWO of my comments.

PART THREE includes articles and videos recommended for your review and thoughtful consideration as you revise guidelines for RF/MW. PART TWO: Anecdotal reports.

History is full of anecdotes - yet often utility decision makers and government entities choose to discount true stories about personal effects experienced from exposure to EMF. Many people who have EMF sensitivity cannot even attend public hearings and public input sessions due to the proliferation of wireless tech. Some others, like myself, have interviewed sensitive individuals and found, e.g., these three incidents:

ONE. A woman in Eugene, OR, wrote a letter to the EWEB Board describing how a digital natural gas meter had been installed at her house; she slept less than two feet away from it for almost two years and became quite ill. It was not until she met a local doctor that went to her house and discovered this _NON SMART_ meter (what a gas company upper level employee called it) was emitting every 14 seconds that she discovered the source of her health problems and took steps to mitigate them by having the meter removed. This is brought up to show how little the utilities are informed and if informed willing to provide information to the public about transmissions sometimes seen as intellectual property.

EWEB board members had said that wireless gas smart meters had been installed and there were NO PROBLEMS!

EXAMPLE TWO. A California woman called me with her story about how she could no longer use electricity at night in her house but had to use a flashlight after dark. She and her retired husband, (a scientist and she and he technology specialists), had moved into an apartment with wireless smart electric meters 40 ft. away from their living space, but she experienced numerous health problems. By the time she called me, they had spent most of their retirement savings and were trying to find a safe place for her to survive. I do know where she ended up.

(When they had moved into a house with solar electric cells, by the way, they had to have the PVs inactivated due to fields caused by the inverter that adversely affected her.)

EXAMPLE THREE. A woman called me from North Dakota who had to use candles at night because she could no longer be exposed to electricity due to her reactions to a wireless water smart meter installed on the other half of her duplex. Her symptoms included skin tingling (a decades long piano player, she could no longer play the piano); her heart palpitations caused her to see a doctor because she thought she might have a heart attack. She threatened to sue her water utility if a wireless digital water meter were installed on her side of the duplex. She ended up vacating the rental where she had

lived for several year. PART THREE: Research _Smart Meters: Correcting the Gross Misinformation_ should be required reading - signed by 50 international scientists and health professionals. (6.11.12). The article can be easily found by putting the title in a search engine.

Also pls. see the two part video (one hour total) of Dr. Paul Dart whose live presentation to EWEB 7.23.13 can be found at RadiationReport (DOT) com/Smart Meters He also presented to them a 70 page written report which may soon be on the Internet. Dr. Dart, M.D., Eugene, OR, six other doctors and an engineering professional reviewed 200 medical articles over 18 months and assembled an illuminating slide show outlining the findings of cell phone studies in many nations (but the USA is notably absent from most studies).

Dr. Dart, M.D., Eugene, OR, six other doctors and an engineering professional did a review of 200 medical articles over 18 months and assembled an illuminating slide show outlining the findings of cell phone studies in many nations (but the USA is notably absent from most studies).

Part Two of Dr. Paul Dart videos (numbers refer to minutes/seconds)

For your convenience I provide a few of the remarks to the best of my ability and locations on Part Two of the two part video footage at RadiationReport (DOT) com/SmartMeters - 6:18

INCREASED BREAST CANCER Netanya, Israel relative cancer several hundred percent more in males and females but especially in increased breast cancer in women near a cell phone tower 1500 watts, 850 megahertz but 1000 times less than FCC guidelines for 850 megahertz exposure. Comparing cancer rates with 677 persons near cell tower versus 1,200 matched controls in another area of the city, significant increased rates of cancer especially

BREAST CANCER INCREASE IN WOMEN 9:14 CANCER DEATHS In Bela Horizonte, Brasil, a town of 2 million rated as the best quality of life in Latin America by the UN one year, a 2011 study was done by which date 856 cell towers installed. Up to 500 meters from a cell tower there were significant increases in cancer deaths.

12:12 FEMALE MICE Subject female mice in Thessalonica, Greece, kept in VHF/UHF antenna park with power densities 1,000 times lower than FCC guidelines; after five matings, female mice were all sterile and this was irreversible even when they were moved. 14:40

NESTING BIRDS Compared storks nesting near cell tower site - 30 nests within 200 meters versus 30 nests within 300 meters; total productivity significantly decreased; partial productivity changed but not statistically significantly nests without young significantly increased in nests with the exposed

birds.

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Also pls. view the one hour fourth video on the <RadiationReport (DOT) /SmartMeters> site with the public input of 18 persons recommending to EWEB to put an indefinite moratorium on installing wireless smart electric and water meters (8.6.13).

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Pls., especially those who are medically trained on staff, become familiar with this article published in 2013 by Martin Pall, Ph.D., Professor Emeritus, Washington State University: <[http://onlinelibrary \(DOT\) wiley.com/doi/10.1111/jcmm.12088/abstract](http://onlinelibrary.wiley.com/doi/10.1111/jcmm.12088/abstract)>

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GOVERNMENTS AND ORGANIZATIONS THAT BAN OR WARN AGAINST WIRELESS TECHNOLOGY (Put the above title in a search engine for a wireless tech warnings chronology assembled by the Cell Phone Task Force (DOT) org

Radiation Sickness; Jeraldine Peterson-Mark Comments, Sep. 3, 2013

**Comments on Notice of Inquiry, ET Docket No. 13-84**

Jeraldine Peterson-Mark  
LMT 6014, RCST®, WMMT, NCBTMB 556929-08  
120 Alamo Drive  
Santa Fe, NM 87501

I am Nationally Certified Biodynamic Craniosacral Therapist and Licensed Massage Therapist.

I am an individual who is sensitive to electromagnetic radiation. My health and immune system are challenged in environments that are overcrowded with modern electronic instruments such as cell phones, Wi-Fi, Bluetooth technology, high powered light fixtures, scanners and electronic medical devices. I become fatigued, irritable, headachy, confused and have even lost my balance on occasion. It is challenging for me to spend any length of time in shopping centers, airports, grocery stores, college campuses, movie theaters, restaurants, hotels or hospitals. Now, as more and more cell towers are being erected in my neighborhood, and neighbors are opting for Wi-Fi access, I am becoming more exhausted and un-well feeling living in my own home.

In November of 2010, I discovered quite by accident that my local gas company had installed an Automated Meter Reader (AMR) on my home's gas meter located on the wall outside of my bedroom window just 2 feet from the top of my head where I sleep. I suffered from insomnia, wheeziness, a metallic taste in my mouth, indigestion, brain fog and general aches and pains which were not the norm for me at the time. After requesting that the AMR be removed, all symptoms disappeared within 3 days.

I have discovered in the past few years that I cannot ride in "Smart Cars" (electric cars) as they give me an immediate head ache. I cannot talk on a cell phone for more than five minutes without experiencing jaw pain, ear ache and neck spasms. I cannot stand in the same room with a microwave without my heart rate increasing (I do not have a pace maker). I discovered that I could not hold the radio signal Bluetooth game controllers for the Nintendo Wii® for more than ten minutes as my wrist and elbow began to ache and then I become dizzy and disoriented. And medical procedures using Ultra sound, CT or MRI's cause the tissue that is being scanned to become sore and swollen and leads to nauseous, exhaustion and dizziness (no contrast dyes used).

Additionally, I work from my home as a Nationally Certified Craniosacral Therapist and Licensed Massage Therapist. Many of my clients are elderly and have compromised immune systems due to battling cancer and receiving chemotherapy and radiation, Type 2 Diabetes, Multiple Sclerosis, Rheumatoid Arthritis, Lupus, or Multiple Chemical Sensitivities/Multiple Environmental Sensitivities and cannot tolerate prolonged exposure to electromagnetic "fog". My home is free from Wi-Fi and Bluetooth technology. We choose to use land lines instead of cell phones while in the home, but still many of my clients feel the effects from the surrounding neighborhood's electronics and radio signals.

In closing, it is becoming more and more difficult for me to feel well rested and to work effectively with my clients, and for my clients to heal, in a world where every other month a cell phone company feels they must erect their own tower a few blocks from an already existing tower, or add even more signalers to the dozens already providing flawless, potent signals. Please take note: other countries are currently removing their Wi-Fi technologies and returning to fiber optics and land lines. Please don't let electromagnetic pollution become the "we should have seen that one coming" cause of the 2020s. I do not want any more of my family and friends to become ill from, or die from, tumors in the head and neck, and autoimmune diseases, before they turn 50.

Dozens of scientific studies have shown negative impacts of EMR on human health, even at low levels of exposure. The most commonly accepted guidelines are the Building Biology recommendations that list 1,000 microwatts/m<sup>2</sup> as the threshold for "extreme concern" ([http://www.baubiologie.de/downloads/english/richtwerte\\_2008\\_englisch.pdf](http://www.baubiologie.de/downloads/english/richtwerte_2008_englisch.pdf)). On May 31, 2011, the World Health Organization's International Agency for Research on Cancer (IARC) classified radio frequency fields as "possibly carcinogenic to humans." The FCC does not use biologically determined guidelines that affect health, but rather uses a standard that measures thermal heating of biological tissue. The premise that there are no adverse impacts of EMR on the human body until it is cooked is completely ridiculous.

I urge the FCC to adopt new LOWER RF safety guidelines that take into account published research on the biological effects brought on by the ability of RF signals to communicate with living tissue, and more specifically, to consider the Building Biology guidelines for human health.

Radiation Sickness; Edward G. Comments, Sep. 3, 2013



Comments on Notice of Inquiry, ET Docket No. 13-84

The current RFR exposure limits have impacted my well-being and caused me to experience health problems. All living creatures living in my home began having symptoms of chronic sleep disorders, headaches, digestive disorders and mental health issues within about 3 months of cell phones signal strengths increasing in home and smart meters being installed.

I have receipts dating from spring through summer 2013 for doctors and veterinarians prescribed medicines which required continuous use to control symptoms. The symptoms began to subside only after disabling all cordless phones, all home Wi-Fi systems, all Bluetooth devices, and covering both smart meters and windows with aluminum screens.

All the birds and bees in the immediate area a flown or disappeared and only can be seen occasionally on outskirts either early in mornings or ahead of storms.

I currently limit the use of my cell phone and would really very much wish to keep 24/7 RF radiation from cell towers and smart meters out of my living area and bedroom especially from sundown until sunrise.

Photos of costly attempts to prevent RF radiation from 24/7 entrance to home results of some side effects are included below.



Multiple smart meters with over 100 foot range placed within 30 feet of living and sleeping area. The 2 smart meter for my neighbor is placed in yard doubling my 24/7 radiation exposure.



Aluminum foil covering smart meters to significantly reduce 24/7 radiation without any measurably negative effect upon meter performance. This suggests over radiation.



Covering entire windows and doors with aluminum screening only slightly reduces 24/7 rf entrance into home.





Covering entire windows and doors with aluminum screening only slightly reduces 24/7 rf entrance into home.



Chronic bloody stool syndrome during periods of maximum rf radiation exposures.



Chronic bloody stool syndrome during periods of maximum rf radiation exposures.

Radiation Sickness; D. Yourovski Comments, Sep. 4, 2013



To: The Federal Communications Commission

From: D Yourovski

Date: September 3, 2013

I am writing to you in behalf of myself and for all children and other residents of our grand USA and I am asking, pleading, you to revise the standards for human exposure to radio frequency radiation. In the best interest of our nations most valuable resource, our children, I'm imploring you to seriously consider not only the immediate but long reaching consequences to humans through EMF exposure, and revise the standards to be more restrictive than we presently have in place.

I personally have been affected by the radio frequency radiation. Working in public schools in the computer labs, I have been taken out of the lab by wheelchair during a workshop from becoming dizzy, disoriented, slow of speech, and feeling extremely fatigued and my family called to come take to the doctor.

Sometimes, going into banks and McDonalds? and other places where WiFi?s are in place, even when I'm not aware that they had WiFi?s I've become ?wobbly? and my walking has become impaired and had to hold to walls or get assistance to quickly and safely exit the building without falling.

Working for numerous years in the public schools in multiple classrooms as a ?floater? I've worked regularly with all grades and all classrooms of the schools. I've observed first hand the differences in the children?s emotional behavior, their attention spans, and their attendance records as part of the day I also for five years charted all daily attendance for all schools.

I first hand noted that with the introduction of WiFi?s and the EMF exposure that the children struggled more to learn, had more arguments, aggression and fights with other students. It was interesting to observe that the classroom closest to the hub that housed all the computer infrastructure had on a daily basis the highest percentage of absences year after year?so we are talking different students each year in this room, yet still the highest absences.

Observing students first hand for so many years, it?s really easy to connect the Attention Disorders to our exposures here. Clearly, as much federal and state money as we put into our nation wide campaign of ?NO CHILD LEFT BEHIND? it?s like pouring water into a bucket with holes in the bottom if we are exposing our children to these EMF. How can we expect our children to perform their best and reach their personal potentials if we shackle them with the symptoms that the exposure to EMF?s causes.



Look at other nations around the world. They are taking note and protecting their children. Look at Canada and India in the news in 2012 and 2013.

Largest Teacher's Union in Canada Declares Cell Phones, WiFi Radiation Hazards

Supreme Court of India Orders Cell Towers Removed From Schools, Hospitals

Cell towers are being dismantled by the thousands in various parts of India.

In August 2012 a petition was filed in the Israeli Supreme Court asking the court to ban WiFi in public schools

In this country people with electrical sensitivity are protected by the Americans with Disabilities Act and the Fourteenth Amendment. Yet, we have a company like AT&T who are trying to increase the radiation from its cell towers without public hearings and new permits, as in the case between AT&T and the City of Santa Fe.

Yes, we need your help and support to protect our children, our citizens already disabled from electrical sensitivity and the rest of our citizens which would include you and your families from becoming affected and even disabled by the EMF exposure.

Once we were known by the world as the "leader" of the world. We've really slipped off that spot, haven't we? Would you help us to move to being known as "The Nation Who Cares for Her Own" and help protect our brains, our lives. Yes, our country. WE ARE THE PEOPLE—that's what America is about. Help us hold true to being just that. FOR THE PEOPLE.

Please, I implore you to stand with us, stand for us—the people. Preserve our nation by preserving our people.

Thank you sincerely,  
D Yourovski

Radiation Sickness; Ellen K. Marks Comments, Sep. 3, 2013

Ellen K. Marks  
16 Amanda Lane  
Lafayette, CA 94549  
925-285--5437

September 2, 2013

To: FCC

Re: FCC Docket #03-137

My husband suffered a seizure and diagnosis of a glioma in 2008. 10 days later Senator Kennedy had a seizure and the same diagnosis. Our son had interned for Senator Kennedy and soon heard concerns from those in his office that the Senator's family felt his tumor was attributable to his long term cell phone use. Since that time many scientific experts, including neurosurgeons, have also stated that Kennedy's death was more likely than not due to his cell phone use.

Shortly after my husband's devastating craniotomy our son brought this correlation to my attention. My husband was an early adopter of a cell phone (1986). He held the phone to his right ear for over 20 years. He used it often as it was a valuable tool for his real estate development and sales business. Had he been advised that holding the cell phone to his head may cause brain cancer he never would have held it to his head jeopardizing his life. Had our government required pre-market safety testing and standards that are not manipulated by industry this could have been avoided. You have the opportunity and obligation to do the correct thing now for every man, woman and child in America.

Upon hearing this correlation I immediately began researching cell phones and brain tumors. There were excellent studies by credible scientists worldwide showing an increased risk of glioma after 10 years of use on the side of the head to which one held the phone. I sent my husband's medical records and cell phone records to many leading experts around the world who concluded that his brain tumor was more likely than not a result of his cell phone use to his head. He had no other contributing factors.

Since speaking out on this publicly before Congress and on many national television programs I have been contacted by many others who also held cell phones to their heads for many years and have a brain tumor, acoustic neuroma, or salivary gland tumor. Many are much younger than my husband (56 upon diagnosis) and sadly many are now deceased leaving behind small children and/or grieving parents. They are as young as 18. Had they been advised that holding the cell phone to their head might cause a brain tumor they too would not have jeopardized their lives. I repeat, had our government required pre-market safety testing and standards that are not manipulated by industry, this could have been avoided.

As you are aware, in 2011 the World Health Organization/ International Agency for Research on Cancer (IARC) classified radiofrequency electromagnetic fields as possible carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer, associated with wireless phone use. Yes, this has been disputed by some industry funded groups but the recently printed IARC Monograph confirms this classification. Non-industry experts assert that radiofrequency electromagnetic fields should have been classified a probable carcinogen.

This industry thrives on the facts that this possible carcinogen is invisible, loved by so many, and the latency period between exposure and tumor is lengthy. This is a powerful trillion dollar industry manipulating our government. This industry has an enormous impact on the global economy. This industry was not able to obtain liability insurance as they were rejected by the insurers. There are many lawsuits already underway in the United States concerning cell phones and brain tumors. The brain tumor rates in the frontal and temporal areas of the brain are increasing (areas closest to the cell phone when held at the ear). This cat cannot be kept in the bag much longer and what will the public think of the FCC when this greatly manipulated issue finally surfaces? It is time you stop this corporate bullying and give Americans back their right to life, liberty and the pursuit of happiness.

The industry is hiding safe use information (per the FCC) in tiny print in manuals no one sees, or worse, only on the phone which no one would ever consider looking at even if they knew how to do so. The iPhone does not come with a manual any longer and to read about rf exposure one must hit 1) settings, 2) general, 3) about, 4) legal, and finally 5) rf exposure to read that the phones are tested with a 10mm separation from the body. It goes on to say that one should "carry iPhone at least 10 mm away from your body to ensure exposure levels remain at or below the as-tested levels". It also states that "although this device has been tested to determine SAR in each band of operation, not all bands are available in all areas. Bands are dependent on your service provider's wireless and roaming networks." Who is going to know to go through those 5 steps to see this information which is conveniently hidden? ***Isn't it the job of the FCC to ensure standards take into account ALL bands when setting the exposure limits?*** The average consumer does not know about bands and they also feel they have no reason to concern themselves as they are misled into thinking that our government had deemed cell phones, as currently used, safe. That is incorrect.

The FCC states in OET Bulletin 65 that the standards must be based on ordinary operating use. Normal operating use is smashed to the ear and kept in the pocket or the bra. Currently your standards do not protect consumers from normal use. Currently industry hides the information that emissions may be exceeded when users use them directly to the head or while kept on while on the body. Considering children as young as 5 have cell phones (and the radiation is absorbed further into their brains and bodies) and 87% of teens sleep with them on under their pillows all night long and keep them in their pockets all day long, this is certainly of utmost importance. The FCC has been given the job to set the standards despite the fact you do not have the scientific expertise to do so (per Mr. Knapp). You are obligated to protect the health of the American people.

I have met many of the other victims of cell phone induced cancers personally. Brain tumors destroy the very soul of a human being and take the entire family down with it. I have stood and watched many buried in front of their small children. The victims begged me on their deathbeds to continue to spread the word and to get our government to take action. This has been a devastating journey for far too many and we are only the tip of the iceberg. It tortures me, as it should you, to think of the damage being done now as brain tumors have a long latency period. The FCC has the power to change this and save lives.

I have learned more than I ever wanted to learn on the subject of cell phone radiation. I testified next to Mr. Knapp of your Office of Engineering and Technology and he made it clear that the FCC had not changed its standards in what was then 12 years because no one had told them to do it. Well, now the Government Accountability Office has told you it is needed. The door to doing the right thing has been opened for you. It is time to cross the threshold of righteousness and stop this corruption. You have a responsibility to the citizens of the United States; not to the industry and their corporate greed. Our economy will not collapse because you set the standards appropriately. More lives will be lost and America's moral fiber will be destroyed if you do otherwise.

I met with the GAO while they were researching this issue. I helped explain the inadequacy of the current testing and standards. I also explained, as did many others, that the current standards only protect us from the thermal effects of cell phone radiation while hundreds or possibly thousands of studies have shown deleterious health effects from this non-thermal radiation. It is highly unfortunate that the Government Accountability Office omitted the critical information concerning non-thermal effects of cell phone radiation from their report as this is paramount to this issue. You can no longer ignore the fact that this radiation is penetrating the blood brain barrier and damaging DNA. With the current "dose and duration" of the average American this MUST be taken into consideration.

This fate can happen to anyone. Please see my attached list of notable persons who have been diagnosed with a primary brain tumor (including acoustic neuroma and salivary gland tumors) since 1995. Excellent science is telling us that there is a significantly increased risk of glioma after 10 years of use, thus the 1995 criteria. I am not saying that their tumors (and deaths of many) are absolutely attributable to their cell phone use. I am saying that is plausible. For every notable person there are hundreds, if not thousands, of average Americans suffering the same fate. If there is any risk at all, and we all know that there is, your standards MUST be changed now to protect public health.

The standards left as is or made less stringent would continue to be a crime against humanity.

Thank you.

Ellen K. Marks

Radiation Sickness; Melody Graves Comments, Sep. 3, 2013



## Comments on Notice of Inquiry, ET Docket No. 13-84

Dear members of the FCC,

The current RFR limits have impacted my well-being and caused me to experience health problems.

My symptoms began in late 2009 when I realized that every time I used my cell phone, I would get a bad headache. I realized shortly thereafter that my recurring headaches happened whenever I used a cell phone, wi-fi on my computer, or was near a person using a bluetooth hands-free device. I could not go into coffee houses with free wi-fi, because I started noticing a pattern of headaches and cardiac arrhythmia (heart palpitations) whenever I stayed in such an environment for more than a few minutes.

I stopped using my wireless router at home and hard-wired everything to a Cat-5 Ethernet network because I began to hear a machine-gun fire clicking noise at night when I was about to fall asleep. Later, after I educated myself on the dangers of RFR and purchased a high-frequency RF meter, I realized the clicking noises were the sound of the high-frequency microwave pulses coming from my wireless router, which are inaudible to most people except the RF sensitive. My sleeping improved tremendously, and the feeling of unrelenting fatigue and a lingering dull headache in the mornings was gone.

My health and sleeping improved dramatically until a smart meter was installed on my home without my consent when I was on vacation. Immediately, I noticed persistent migraine-type headaches whenever I worked in the kitchen, the side of the house where the smart meter was installed. During complete power failures, the headaches were non-existent and my body felt relaxed and able to rest. Now I avoid working in the kitchen for long periods unless I wear RF shielding garments, which help somewhat to mitigate my headaches and fatigue.

Now, with the proliferation of smart phones with wi-fi, Bluetooth, and 4G and 5G data streams, I cannot be within three feet of someone with an iPhone, Blackberry, or similar high-powered smart phone without getting headaches, nausea, heart palpitations, and brain fog (impaired higher critical thinking/reasoning skills). I cannot be in the same room as a 2.4GHz cordless phone without experiencing brain fog, intense headaches, nausea, and cardiac arrhythmia.

I forego public places and gatherings as much as possible because of the saturation of personal wireless technology, and I have had to stop attending my church because the church installed a commercial grade wi-fi system for the sanctuary so people could use their iPads and interactive Bibles during the service. The first Sunday I attended after the installation, I had to leave after about ten minutes because my headaches and nausea were so intense. A few subsequent visits with the same symptoms

told me it was the wi-fi. This kind of thing happens frequently, leaving me feeling isolated and unable to participate in the good things in life and society.

I cannot fly on a commercial flight that is wi-fi enabled without significant pain and suffering and a weakened my immune system, resulting in me frequently catching colds and viruses whenever I have to travel by air for long distances.

I have to find hotels with wired internet connections and specific deployment of their wireless, cooperation with the hotel engineer, and the availability of rooms that are far enough away from wi-fi access nodes to allow me to sleep and avoid becoming ill whenever I stay in a hotel. For a period of about two years, I did not stay in a commercial hotel and bought an RV so I could camp in state parks and other places without wi-fi. However, now state parks and most RV campgrounds are equipped with wi-fi transmitters and/or smart electric meters, so the problem has become so widespread that there seems to be no safe place anymore where I can stay.

Furthermore, finding a house in a place without cell tower radiation is next to impossible in urban areas where jobs are available. The ability for an individual to lease out space in his back yard or office parking lot for a cell tower is ridiculous, and it makes it very difficult for people who are sensitive to know if their neighborhood is going to become a radiation war zone overnight.

I work from home helping others with RFR sensitivity and have pretty much given up on ever working in a traditional office environment because of the prevalence of wireless technology in the workplace. Many people I know who are sensitive deal with constant headaches and health problems simply because they don't know that their quality of life could be improved if they eliminated or reduced their RFR exposure. Many do not have the choice of reducing their exposure because of where they live, dependence upon a specific job, etc. One of my clients has a 4 year old son with severe behavioral problems and learning challenges which completely disappeared after reducing his exposure to RFR and electrical fields inside the home. It makes me wonder how many other ADHD children and autism spectrum children could be helped by simple improvements in their RFR environment.

This type of pulsed microwave radiation has been shown to affect delicate cardiac rhythms, and medical doctors advise any patient with a pacemaker to avoid cellular microwave radiation; however, many people with pacemakers don't realize that wi-fi, Bluetooth, and cordless phones emit the same type of radiation.

This type of radiation has been shown to cause DNA damage on the cellular level, which is carcinogenic, and is being used by pregnant women, infants, and children who were never considered in the original safety evaluation. In light of this disturbing disconnect between public awareness of the risks and preventative measures being taken, I think more care and consideration should be taken to evaluate both personal and public exposure limits, for the health and safety of all Americans.

Using thermal effects only to evaluate safety standards and ignoring documented non-thermal biological effects on a cellular level is akin to putting people in a burning house and determining that the environment is safe up until the fire actually starts

burning the occupants' skin. Common knowledge tells us that it is the toxic smoke that kills most people in a house fire, not the flames. I think in a similar way, the FCC should follow the lead of other countries like Canada, France, Israel, and Russia to re-evaluate the chronic, genetic, long-term effects this kind of constant microwave radiation will have on the survival of future generations.

Radiation Sickness; Bernadette Johnston Comments, Sep. 3, 2013

CommentCurrent FCC guidelines for radio frequency radiation allow for extraordinarily high levels of exposure. The FCC is not qualified to set guidelines and should, instead, rely on the recommendations of unbiased medical and science professionals who do not have ties to the telecommunications industry. Findings should be based on science and not on financial reward. Medical and science professionals who work for and/or who stand to profit from the telecommunications industry should be excluded from comments. Further, the testimony of people who suffer from the biological effects of radio frequency radiation and/or the parents and/or guardians of minor children should be taken in account. I began to suffer from debilitating health effects directly attributable to exposure to pulsed non-ionizing radio frequency radiation originating from wireless routers and cell towers in 2010. My symptoms include headaches, heart palpitations, sleep disturbances, difficulty concentrating, and feelings of agitation when exposed to levels as low as 100 micro watts per square meter. In 2011 I became ill when Burbank Water and Power deployed smart meters throughout the city. I had made my home in Burbank for 24 years but found it necessary to move out of the city due to the health effects from which I began to suffer. I have had to move 3 times in 3 years due to intolerable symptoms due to RFR. I currently live in a shielded environment in order to avoid symptoms. Recently the wireless router and DECT phone belonging to a neighbor in the multi-family dwelling in which I live made it necessary to shield the common wall in order to lower the levels of RFR down from 2450 microwatts/square meter to levels that I can tolerate (approximately 5 microwatts per square meter). I do not have equal access to public buildings, businesses, recreational facilities, schools, theaters, airplanes, trains, restaurants, libraries, or entire cities that have city-wide WiFi because I suffer from a constellation of symptoms that make it impossible for me to tolerate many environments. I am not alone in my reaction to pulsed non-ionizing radio frequency radiation. I believe that the current levels that are deemed acceptable by the FCC, IEEE and other similar organizations are extremely hazardous and do not take into account the impressive body of literature that is growing daily. The FCC is charged with the task of setting standards. As such, it must look to true unbiased science, epidemiology, and the testimony of those who are being sickened by RFR \_\_\_\_\_

Radiation Sickness; Shane Gregory Comments, Sep. 3, 2013



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I do not have equal access to public buildings, businesses, recreational facilities, schools, theaters, airplanes, trains, restaurants, libraries, or entire cities that have city-wide WiFi because I suffer from a constellation of symptoms that make it impossible for me to tolerate many environments.

I am not alone in my reaction to pulsed non-ionizing radio frequency radiation. I believe that the current levels that are deemed acceptable by the FCC, IEEE and other similar organizations are extremely hazardous and do not take into account the impressive body of literature that is growing daily.

The FCC is charged with the task of setting standards. As such, it must look to true unbiased science, epidemiology, and the testimony of those who are being sickened by RFR exposures, putting aside the concerns of the corporations and other entities that seek to profit from the proliferations of technology that employs RFR.



Radiation Sickness; Layna Berman Comments, Sep. 3, 2013

I am a health educator and syndicated radio journalist covering the health consequences of microwave wireless, non ionizing radiation for the last fourteen years. I have interviewed researchers, and public policy makers on the topic from across the globe, and read research going back to the 1960s. There is no doubt in my mind of harm both to the environment and to humans. I get new calls daily from people who are getting ill after receiving a smart meter or with the installation of a cellular tower near their home.

In addition, I am now getting ill as well, and can no longer travel to highly populated urban environments without feeling poorly. I'm experiencing the same symptoms of insomnia, heart irregularities, low blood pressure, high resting pulse, headaches, stomach distress and body aches as the people who call me regularly.

Radiation Sickness; Linda Giannoni Comments, Sep. 3, 2013

To the Federal Communications Commission:

I encourage the FCC to strictly regulate the wireless industry with much greater care for people's health, and to include consideration of the documented non-thermal effects of RF radiation which have been largely ignored.

The high levels of radio frequency radiation people are now being exposed to has already caused serious illness and disability to thousands of people. This has been well documented globally. We are no longer in the "precautionary principle" phase. Harm is being done. I am very concerned about everyone's health, but especially that of children, as they are the most vulnerable to RF radiation.. As the rate of chronic illness and cancer rises among babies and children, it should be unthinkable to expose them to more and more damaging RF radiation at home, at school and everywhere they go.

We have lost our freedom of choice. The extreme exposure to radiofrequencies has become unavoidable. I do not choose to use any wireless technology, and I pay a monthly fee to opt out of having a smart meter on my house, yet I am subject to constant radiation from cell phone towers and surrounding smart meter and other wireless technology. Children have even less freedom, as they are dependent on their parents and guardians to reject wireless technology at home and to advocate for better regulation.

Several years ago good friend of mine became seriously ill because of RF exposure, and she has not recovered. The only hope of recovery is to be able to avoid further exposures, but this is now impossible as cell phone towers are going up in previously remote areas and wi fi is everywhere. I learn of more and more people in my friend's predicament. It is not acceptable to sacrifice people's health, to devastate their lives, under the pressure of a profit-driven industry.

I include below excerpts from just one of the international reports available about harmful effect of RF radiation, including non-thermal effects which are most important to consider and yet have been ignored by the wi fi industry and regulating agencies. The excerpts include information about effects on wildlife, including bees, which humans need and depend on.

The following are excerpts from an article published in Biology and Medicine, Volume 4, Issue 4, Pages 202–216, (eISSN: 09748369) entitled, "Impacts of radio-frequency electromagnetic field (RF-EMF) from cell phone towers and wireless devices on biosystem and ecosystem: a review," by S. Sivani and D. Sudarsanam, Department of Advanced Zoology and Biotechnology, Loyola College, Chennai, Tamil Nadu, India, published 6<sup>th</sup> January 2013. The entire article can be viewed at the websites of biolmedonline or omicsonline. 08, the Austrian Department of Health found a higher risk of cancer among people living within 200 m of a mobile phone base station and that cancer risk rose with increasing exposure, reaching 8.5 times the norm for people most exposed.

In the Bioinitiative Report, a document prepared by 14 international experts in a nine-



month project, in which over 2000 scientific studies were reviewed, Sage (2007) came to a conclusion that there may be no lower limit that may be safe, and there was a need for biologically-based limits, and children are at most risk.

Urban electro-magnetic contamination (electrosmog) 900 and 1800 MHz pulsed waves interfere in the nervous system of living beings (Hyland, 2000). Growing amounts of published research show adverse effects on both humans and wildlife far below a thermal threshold, usually referred to as “non-thermal effects”, especially under conditions of long-term, low-level exposure (Levitt and Lai, 2010).

According to the Seletun Scientific Statement (2011), low-intensity (non-thermal) bioeffects and adverse health effects are demonstrated at levels significantly below existing exposure standards. ICNIRP/WHO and IEEE/FCC public safety limits are inadequate and obsolete with respect to prolonged, low-intensity exposures (New International EMF Alliance, 2011). New, biologically-based public exposure standards are urgently needed to protect public health world-wide. EMR exposures should be reduced now rather than waiting for proof of harm before acting (Fragopoulou et al., 2010).

According to Levitt (2010), trees, algae, and other vegetation may also be affected by RF-EMF. Some studies have found both growth stimulation and dieback. The browning of tree tops is often observed near cell towers....

In an observational study, it was found that the output of most fruit-bearing trees reduced drastically from 100% to 5% after 2.5 years of cell tower installation in a farm facing four cell towers in Gurgaon–Delhi Toll Naka (Kumar and Kumar, 2009).

Colony collapse disorder (CCD) was observed in beehives exposed to 900 MHz for 10 minutes, with sudden disappearance of a hive’s inhabitants, leaving only queen, eggs, and a few immature workers behind. (Sharma and Kumar, 2010).

EMFs from telecommunication infrastructure interfere with bees’ biological clocks....

In a two-month study in Spain in common frog tadpoles on the effects of mobile phone mast located at a distance of 140 m noted low coordination of movements, an asynchronous growth, resulting in...a high mortality (90%) in exposed group. For the unexposed group in Faraday cage, the coordination of movements was normal, the development was synchronous, and a mortality of 4.2% was obtained (Balmori, 2009).

A study by the Centre for Environment and Vocational Studies of Punjab University noted that embryos of 50 eggs of house sparrows were damaged after being exposed to mobile tower radiation for 5–30 minutes (MOEF, 2010). Observed changes included reproductive and coordination problems and aggressiveness. Tower-emitted microwave radiation affected bird breeding, nesting, and roosting in Valladolid, Spain (US Fish & Wildlife Service, 2009).

House sparrows, white storks, rock doves, magpies, collared doves exhibited nest and site abandonment, plumage deterioration (lack of shine, beardless rachis, etc.), locomotion problems, and even death among some birds. No symptoms were observed prior to construction of the cell phone towers.

In a survey of two berry farms in similar habitats in Western Massachusetts (Doyon, 2008), one with no cell phone towers, there were abundant signs of wildlife, migrating and resident birds, bats, small and large mammals, and insects including bees and the other farm with a cell phone tower located adjacent to the berry patch, virtually no signs of wildlife, tracks, scat, or feathers were noted. The berries on bushes were uneaten by birds and insects and the berries that fell to the ground were uneaten by animals.

In a study on cows and calves on the effects of exposure from mobile phone base stations, it was noted that 32% of calves developed nuclear cataracts, 3.6% severely. Oxidative stress was increased in the eyes with cataracts, and there was an association between oxidative stress and the distance to the nearest mast.

The most affected of the species are bees, birds, and bats and without these pollinators visiting flowers, 33% of fruits and vegetables would not exist.... (Kevan and Phillips, 2001)."

These are just a few examples among many. Thank you for the opportunity to comment.

Linda Giannoni  
Oakland, California 94602

Radiation Sickness; Jennifer Page Comments, Sep. 3, 2013

I have been injured by RF radiation that complies with current exposure limits!

It came to a head beginning of Feb 2013, after living in a place where Wifi was hooked up and a wireless ERT electric meter was pulsating into the house. I was so dizzy I could barely walk across the room without falling, I had severe brain fog, severe heart palpitations and uneven heart rate, headaches, anxiety, a feeling of being "shocked awake" after just a couple hours sleep, my dosage of tapazol had to be increased double after several years of my thyroid being stable. TIA severe migraines came often. Weight loss suddenly became difficult on the same amount of food. I always had to worry about low blood pressure and now I had high blood pressure. Depression increased and so did muscle weakness and fatigue. There would be buzzing feeling in my head. Also I would have problems with my speech patterns and being able to say words in the right order in a sentence. I also noticed my vision deteriorated very rapidly.

All this made doing anything or any kind of functioning impossible. Problems with my memory suddenly became severe. I have skin cancer and it made my lesions grow out of control. Also I have RA and Fibromyalgia and it also aggravated the pain levels many times over.

I did not keep the Wifi router on overnight and one morning I plugged it in and the buzzing and pain in my head were so bad, I had to pull the plug after some minutes and have not plugged it in since-my internet is now hooked up by cables and wireless on computer disabled. Around the same time I demanded the ERT meter be replaced with an analog and it was shortly after. Some of my symptoms improved a lot and some only 20%, as I am still in close proximity to many banks of neighbors ERT meters. I have been noticing speech pattern difficulty and a lot more dizziness in the past 3 weeks and have since found a couple more neighbors just got Wifi.

I also have the same symptoms using wireless phone equipment. I tried Verizon Home Phone Connect and the wireless receiver did the same thing to me as the Wifi, I had to unplug and go to a landline. Use of cell phones for me has to stay to 1 two minute call a month using the speaker w/ the cell phone away from my body, or I get symptoms. I have a cell for emergencies and make sure it is never turned on.

I can not go anywhere any more as wireless is everywhere. I go to a store with wireless and become too dizzy to even manage getting out my credit card for the cashier and almost pass out! I can not go to my local library, restaurants, Dr's offices or hospital, as they all have Wifi and give me these symptoms. I had to stop going to my therapist's office, as after I am there 5 min my speech starts to mess up and I have a headache for the next 12 to 24 hours. When she makes home visits here, which now is all that is possible; my speech is fine, except for the last few weeks I have had intermittent problems due to the new Wifi in my neighborhood.

I am going to have to move, as I can not continue to have my health decline. I will have to find a place that has very distant neighbors so I will not get blasted by any wireless devices they have or be near any cell transmission devices. This is a tall order as I can not work when I can't go anywhere with wireless, and have such compromised health. So I am searching for low income options and working w/ my housing case workers. I am really afraid that if I can't work out a move to a more RF free area that I will soon succumb to a slow painful death from skin cancer and the circulatory problems these technologies

have caused me.

I look back over my life and at the times my health was at it's worse and the biggest decline, I could not figure out happened right after I got a cordless phone in my apartment and used it a lot. This was in 1999 and I had some improvement after I got rid of it in 2005 to about 2008. After that the fibromyalgia took off and so did the RA, at the same time many Wifi networks went up in neighbors houses.

I also worry about the effects these technologies are having on my overall health that I can not feel. I think these technologies are extremely unsafe and should not be used at all as they are. Maybe if an entirely different frequency was used that is more compatible with biology then it could be used at very low levels, but not at the levels that you consider safe now.

These wireless technologies need to be outlawed as they are unsafe for humans and also other animal and plant life.

Radiation Sickness; Jackie Seward Comments, Sep. 3, 2013



My interest and concern with the so called Smart Meters came about as a result of spending two years searching for the cause of a total failure of my health forcing me to go from working full time at a demanding job which I loved to a total collapse in the presence of anything wireless.

In this two year period of time I experienced headaches which became debilitating headaches, increasingly loud ringing and buzzing in my ears which now includes a sore on one ear that breaks out when I am within 10 feet of a Smart Meter, along with concentration and memory difficulties which eventually forced me to give up driving an automobile. I have neuropathy much like a person who had extensive chemotherapy and require prescription pain medication. I also have thyroid problems resulting in total exhaustion, diagnosed as Chronic Fatigue, as well as chronic high blood pressure after a lifetime of very low blood pressure. I have also had emergency surgery for a torn retina that my optometrist had no explanation for other than radiation exposure. I now have a bulge on the other retina which is a precursor to the tearing which required the urgent surgery 3 months after the installation of the Smart Meter January 4, 2011.

Fortunately I found an M.D. who had seen enough of these kinds of symptoms to send me to the Environmental Health Center in Dallas TX where I was diagnosed with severe EMF sensitivities . This exposure over such an extended period of time has created an intolerance of all wireless devices. There is no solution to this other than to avoid anything wireless which includes cell phones, w-fi, and communication towers. Obviously this limits where I live, my ability to drive a car, my ability to even grocery shop, and has created a situation where insurance doesn't cover the expenses of even limited help, which have been considerable as we have also tried to shield the interior of our house to reduce exposure.

The Smart Meter on our house is on the outside of the kitchen wall and radiation inside where I prepare and cook meals measures from .07 to a spike every 60 seconds to as high as 2.00 which is well into the zone known to cause severe health problems. A method called time averaging is used to mask the actual exposure, which, if I may submit is dishonest and allows an unsuspecting public to endure the many other symptoms of radiation known to be caused by these meters such as diabetes, cancer and heart problems. This doesn't even address the increased health problems our children are experiencing since Smart Meters were literally forced upon us.

I beg of you to reconsider radiation safety limits which were set long before we had Smart Meters on every home, 4-5G cell phones plus cordless phones all delivering levels of radiation that amounts to the greatest experiment with human health in history. Not only do we need radio frequency radiation limits but we must develop safer technology and at least provide safe zones for those damaged by this exposure as they are doing in European countries.



Radiation Sickness; Elizabeth Feudale Comments, Sep. 3, 2013

10 years ago I was a very happy, successful and vivacious woman living a life most people would consider the epitome of the American Dream. My husband and I both enjoyed being active and keeping physically fit, and as a result both enjoyed robust good health until, one day, I just stopped being healthy anymore.

Year after year one mysterious illness after another became my constant companion and I struggled to maintain as normal a life as I could for me and my still healthy and loving husband. Finally forced by my mysterious illnesses I had to abandon my career and our beautiful home and was thrust out on a quest to regain my good health and reclaim our former life . After much research we discovered treatments that slowly helped me to regain my former good health and for the first time in years we were sure that my recovery was just around the corner. Then in 2005 I began experiencing some new and even more painful and puzzling symptoms. Every time I used my cell phone my ears would start ringing loudly and after time, if stayed on it for more than a few minutes, my head would feel like it was in a vice and would then start to burn. The same symptoms started happening when I used the computer until eventually every cell phone and every computer in any environment started becoming problematic for me. I tried every way to try to shield myself from the painful radiation exposures, but it soon became clear that the only way to avoid it and the accompanying symptoms was by avoiding all public places (including hospitals) where these devices were being used - efficiently sending me back into total seclusion only this time I couldn't even find safety in my own home as the radiation emitted from cell towers, neighbor's wireless computer systems, and GPS equipped cars passing on the street passed through our home and began sickening me 24 hours a day, 7 days a week, 365 days a year. In the last two years as the networks have ramped up their 2G, 3G then 4G networks I have developed terrible and persistent migraines, atrial fibrillation, circulatory problems, digestive problems, sleep problems and rheumatoid arthritis. The chronic fatigue and fibromyalgia that had previously been cured are back and worse than ever experienced before. I cannot walk, eat, sleep nor think correctly. I cannot clean my home nor care for my husband and I am chronically and clinically depressed. I am only 57 years of age, but feel like a 90 year old woman. And now I'm told that you're going to allow my electric and water companies each to install radiation emitting devices on my house and there's nothing I can do about it.

Is it really neccessary for me to slowly die at 57 years of age in agonizing and unbearable pain just so that people can have faster and faster phones and computers and we can be monitored for our water and electric usage? Does my husband really have to watch me suffer day after day eventually watching his young wife being lowered into the ground so people can speedily read a minute by minute , blow by blow account of every time a celebrity visits a rest room? You are directly responsible for mine and many other's suffering and you can put a stop to it by accepting the non industry generated science about radiation and the human body and putting tougher regulations on the amount of radiation allowable to be transmitted by these devices and cell towers. Today approximately 3+% of the population are suffering as I am, but the number will most definitely grow as you allow higher and higher amounts of radiation to penetrate the bodies of the public. And what of us 3%? Please do no think an apologetic "we had no idea this was doing this to anybody" will suffice

because the science is out there and you are aware of it but are choosing to ignore it. All I know is that I am losing my life and the FCC doesn't seem to care. But I bet you would care if I was your wife, or your daughter or your mother. I bet you'd care if one of your own was going to be killed because of the amount of radiation that you're allowing to be emitted by all of these deadly toys. Sadly, perhaps tomorrow, it will be.....

I am Elizabeth